Figure 1

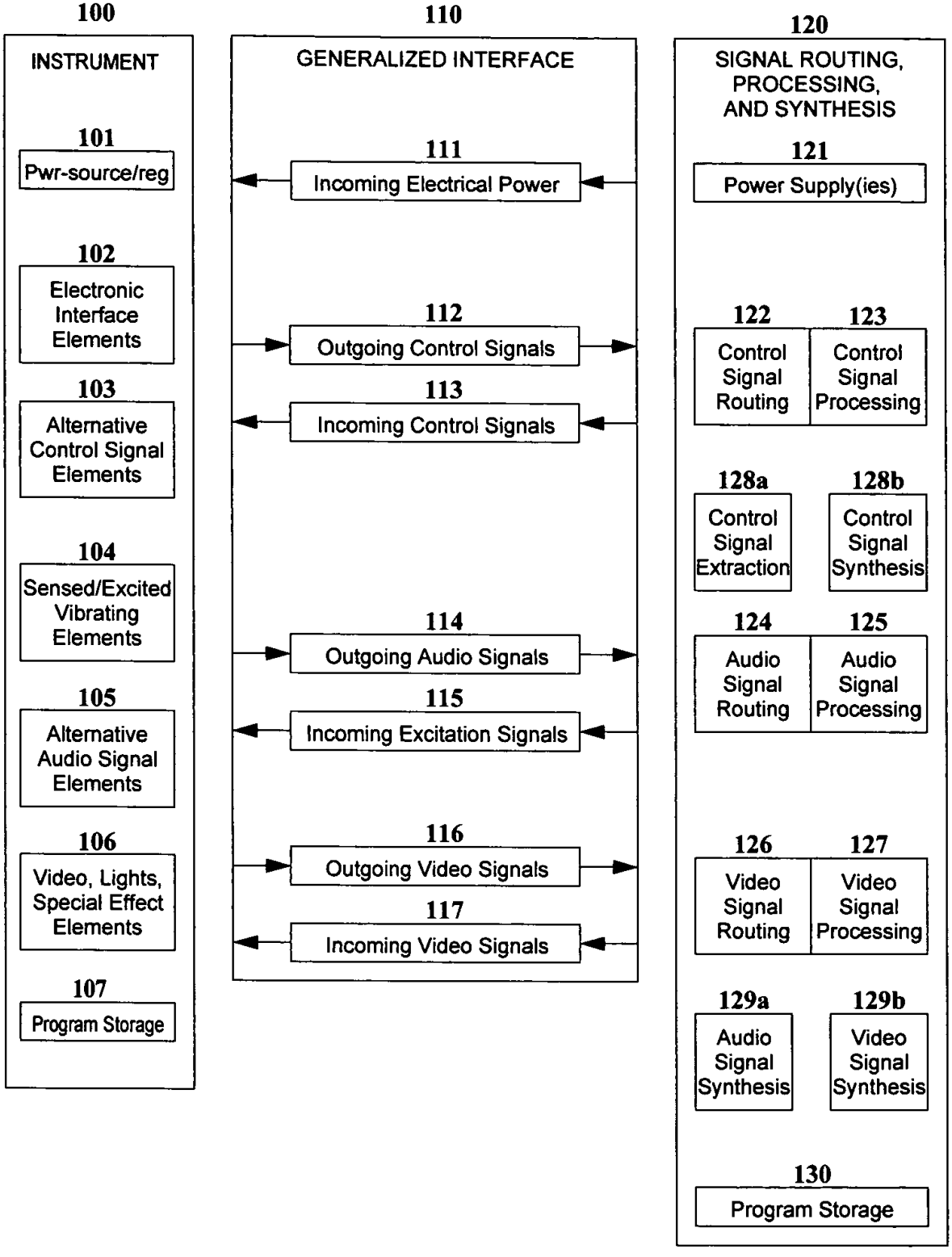

100
INSTRUMENT
101
Pwr-source/reg
102
Electronic Interface Elements
103
Alternative Control Signal Elements
104
Sensed/Excited Vibrating Elements
105
Alternative Audio Signal Elements
106
Video, Lights, Special Effect Elements
107
Program Storage
110
GENERALIZED INTERFACE
111
Incoming Electrical Power
112
Outgoing Control Signals
113
Incoming Control Signals
114
Outgoing Audio Signals
115
Incoming Excitation Signals
116
Outgoing Video Signals
117
Incoming Video Signals
120
SIGNAL ROUTING, PROCESSING, AND SYNTHESIS
121
Power Supply(ies)
122
Control Signal Routing
123
Control Signal Processing
128a
Control Signal Extraction
128b
Control Signal Synthesis
124
Audio Signal Routing
125
Audio Signal Processing
126
Video Signal Routing
127
Video Signal Processing
129a
Audio Signal Synthesis
129b
Video Signal Synthesis
130
Program Storage

Figure 2

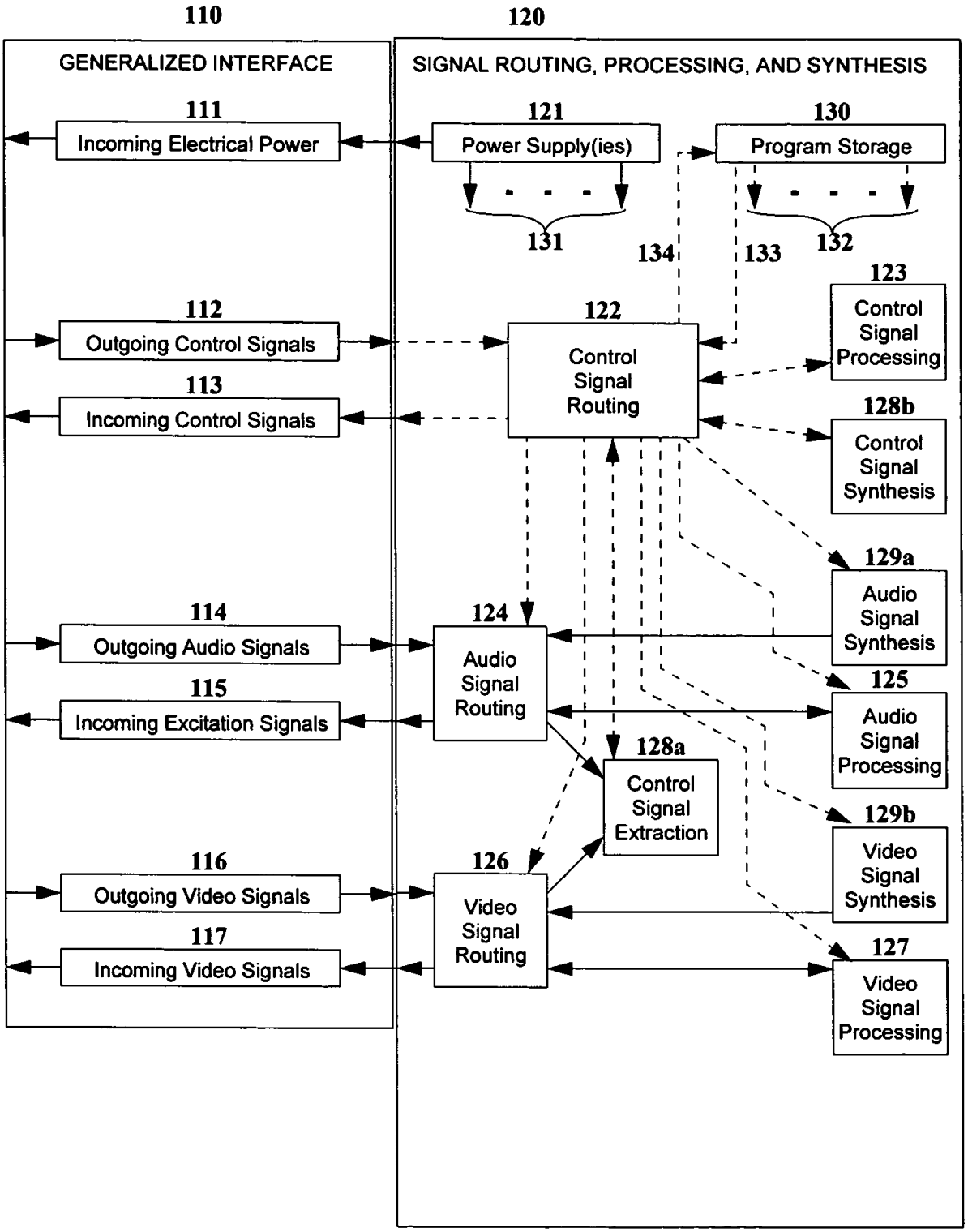

110
120
GENERALIZED INTERFACE
SIGNAL ROUTING, PROCESSING, AND SYNTHESIS
111
Incoming Electrical Power
121
Power Supply(ies)
130
Program Storage
131
134
133
132
123
Control Signal Processing
112
Outgoing Control Signals
122
Control Signal Routing
113
Incoming Control Signals
128b
Control Signal Synthesis
129a
Audio Signal Synthesis
114
Outgoing Audio Signals
124
Audio Signal Routing
115
Incoming Excitation Signals
125
Audio Signal Processing
128a
Control Signal Extraction
129b
Video Signal Synthesis
116
Outgoing Video Signals
126
Video Signal Routing
117
Incoming Video Signals
127
Video Signal Processing

Figure 3A

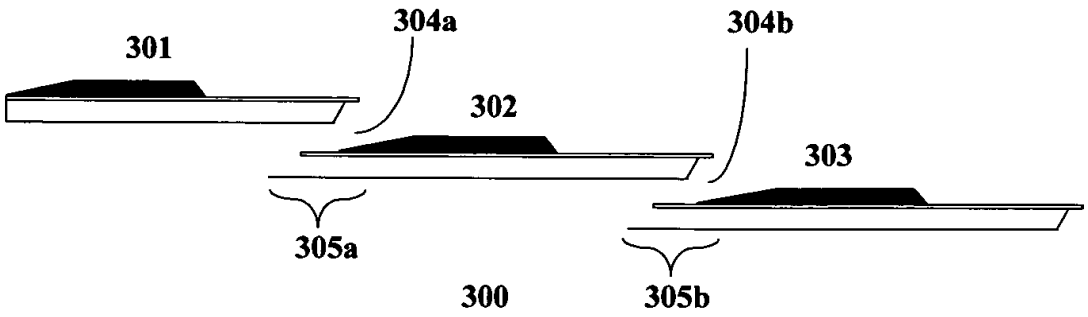


Figure 3B

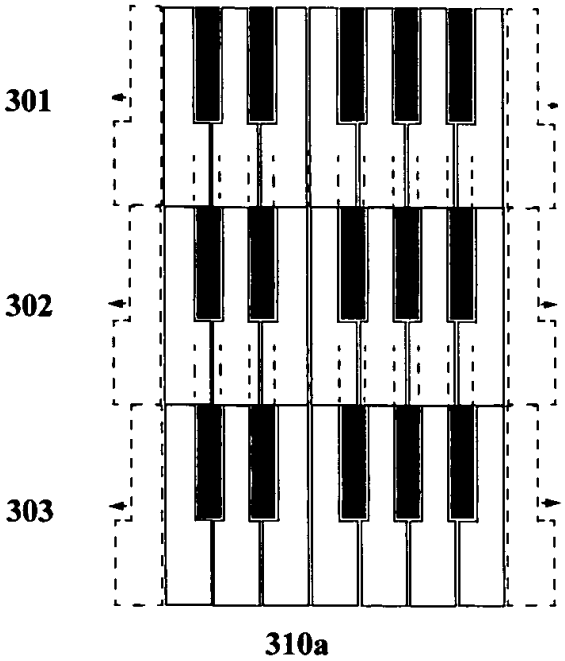


Figure 3C

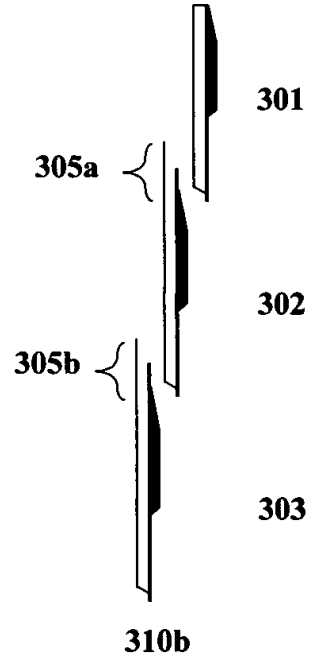


Figure 4

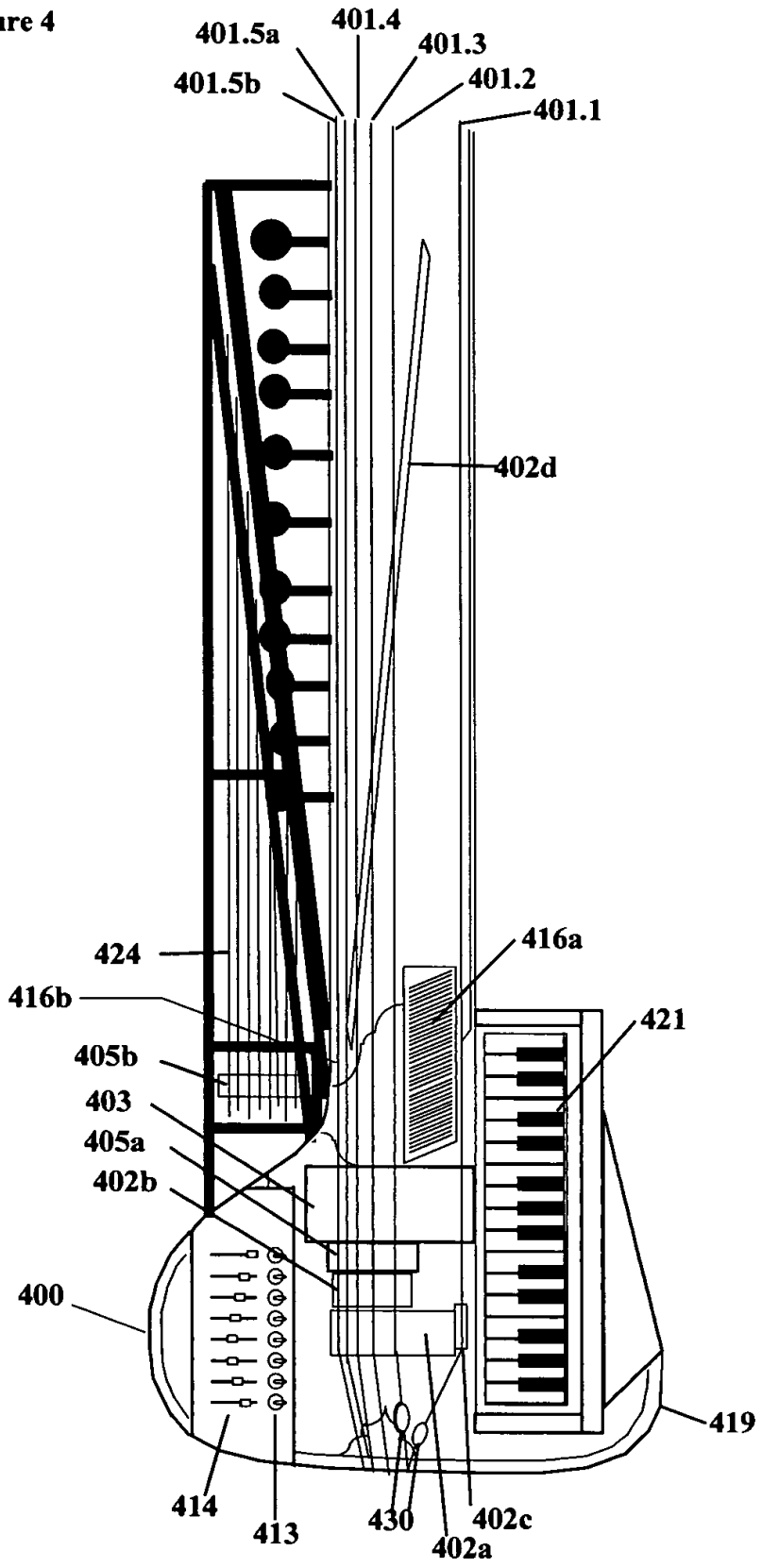

401.5a
401.4
401.3
401.5b
401.2
401.1
402d
424
416a
416b
421
405b
403
405a
402b
400
419
414
413
430
402c
402a

Figure 5

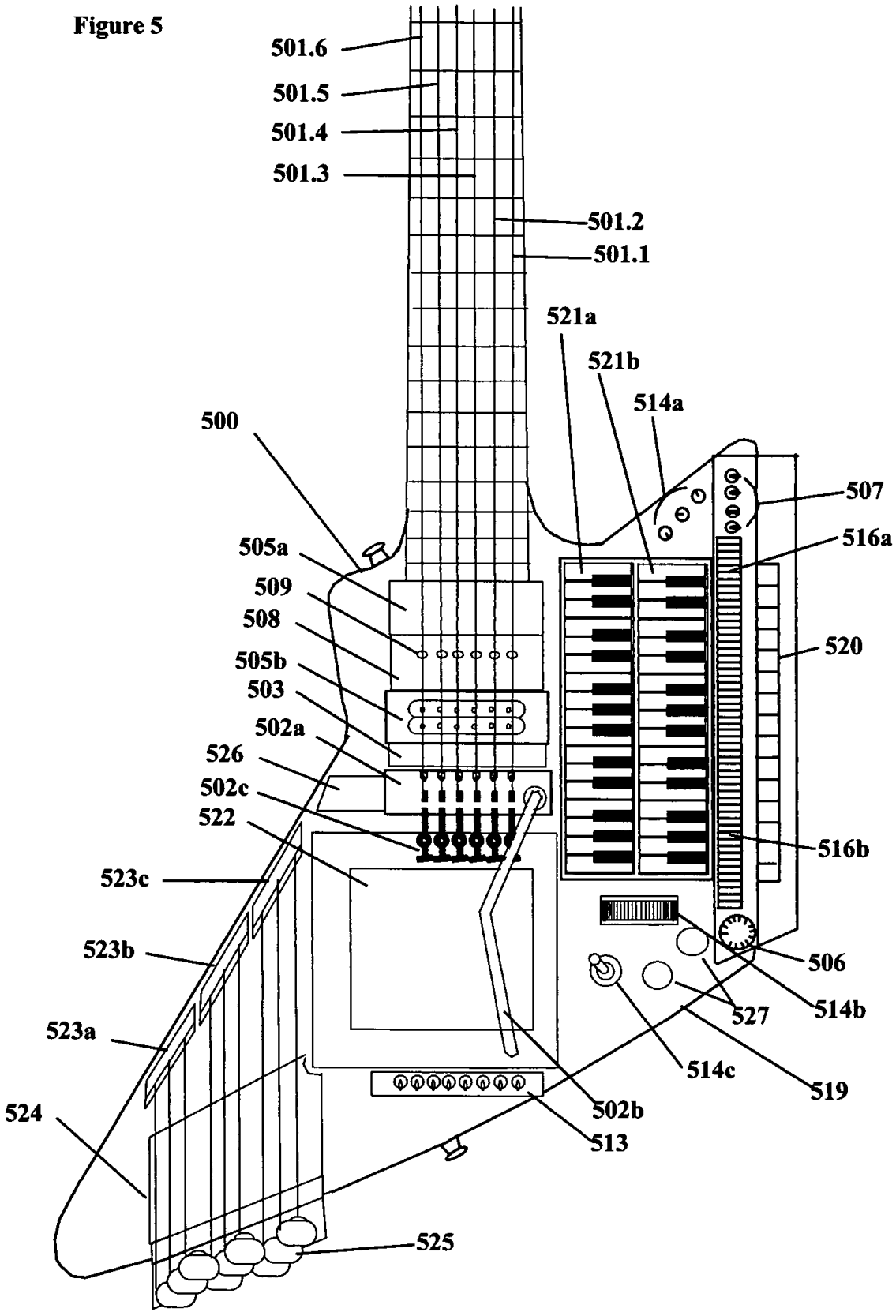

501.6
501.5
501.4
501.3
501.2
501.1
521a
521b
514a
500
507
505a
516a
509
508
520
505b
503
502a
526
502c
522
516b
523c
523b
506
514b
523a
527
514c
519
524
502b
513
525

Figure 6A

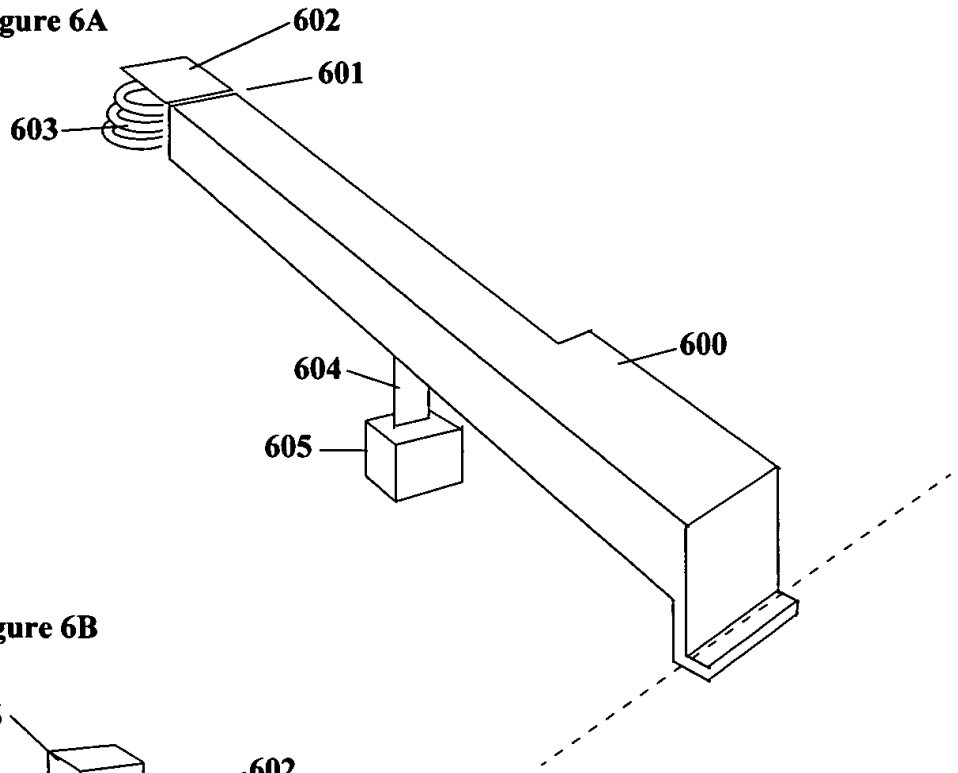


Figure 6B

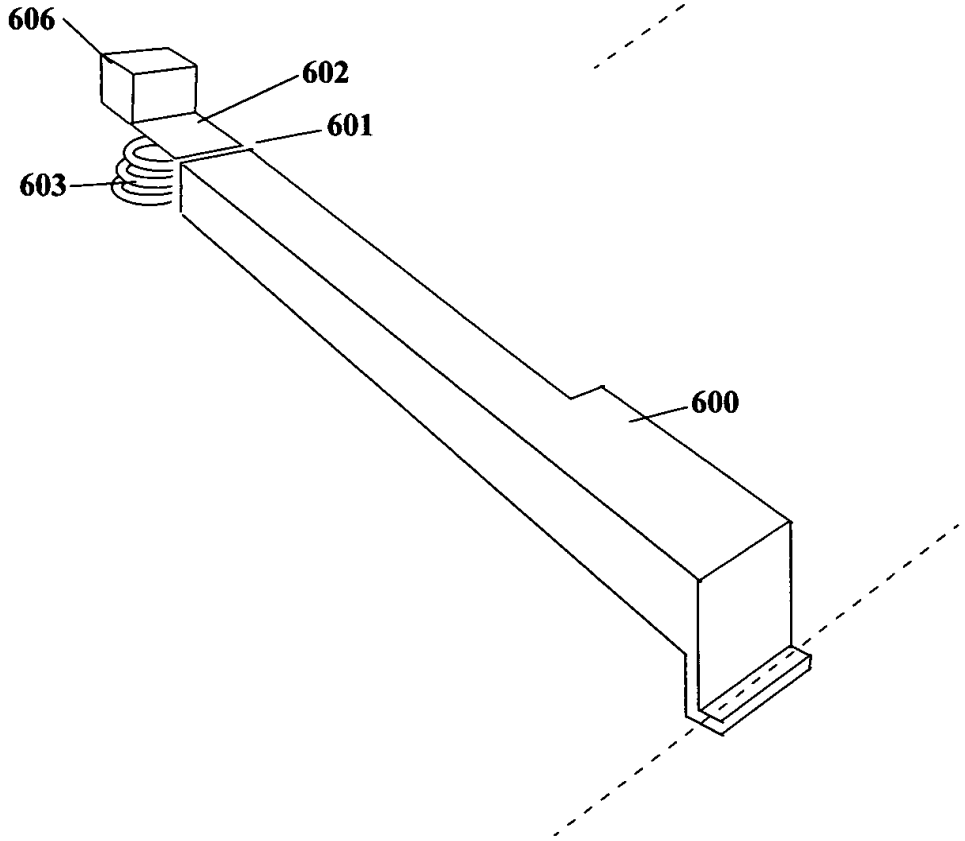


Figure 7A

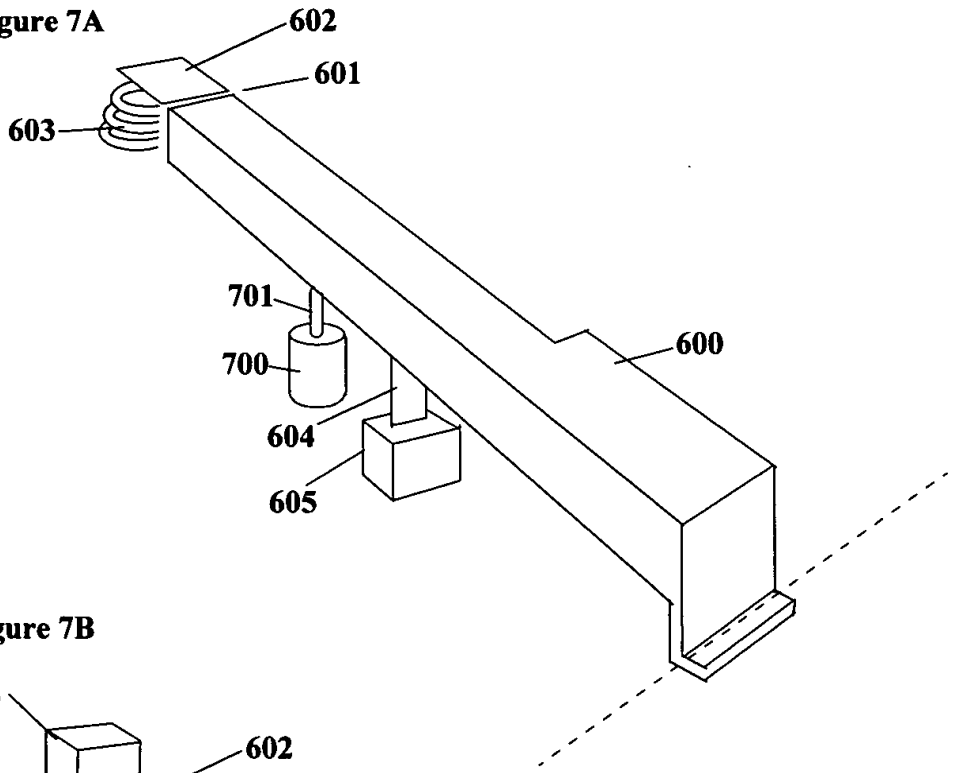


Figure 7B

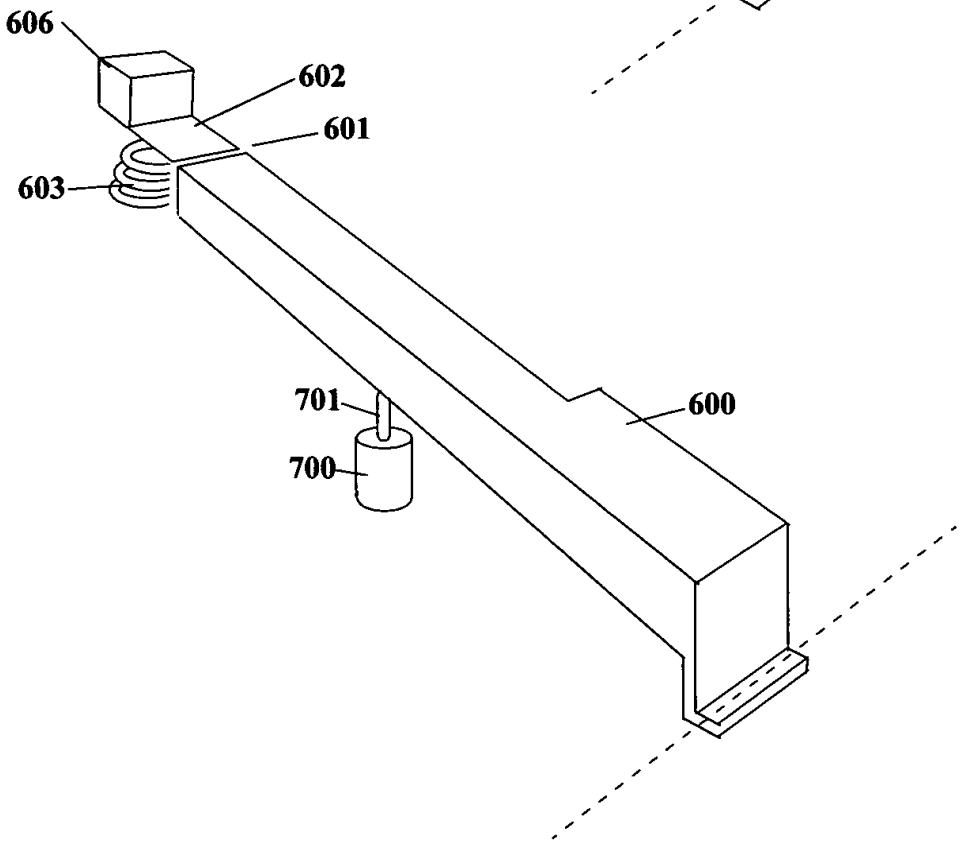


Figure 8

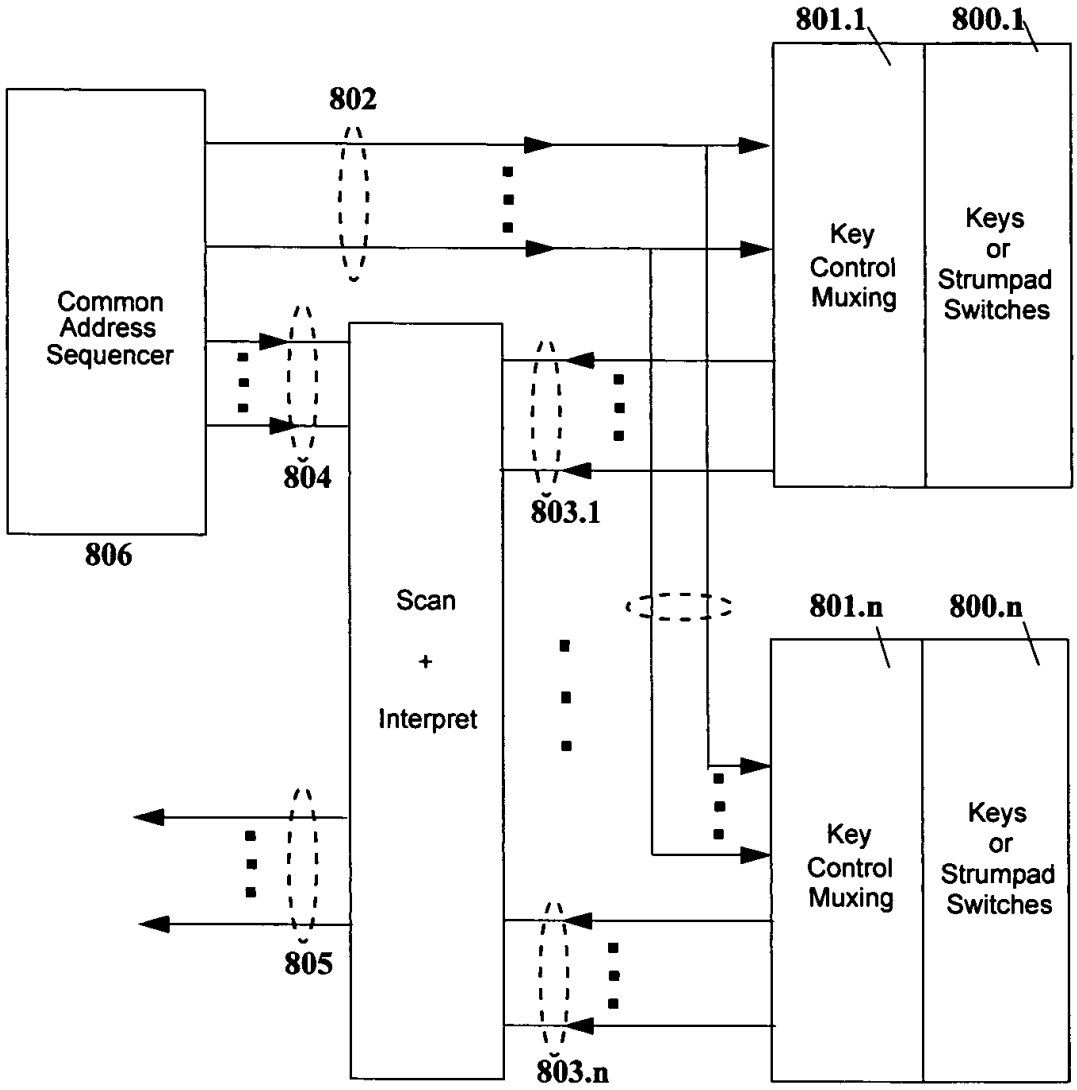

801.1
800.1
802
Common Address Sequencer
Key Control Muxing
Keys or Strumpad Switches
804
803.1
806
Scan + Interpret
801.n
800.n
Key Control Muxing
Keys or Strumpad Switches
805
803.n

Figure 9

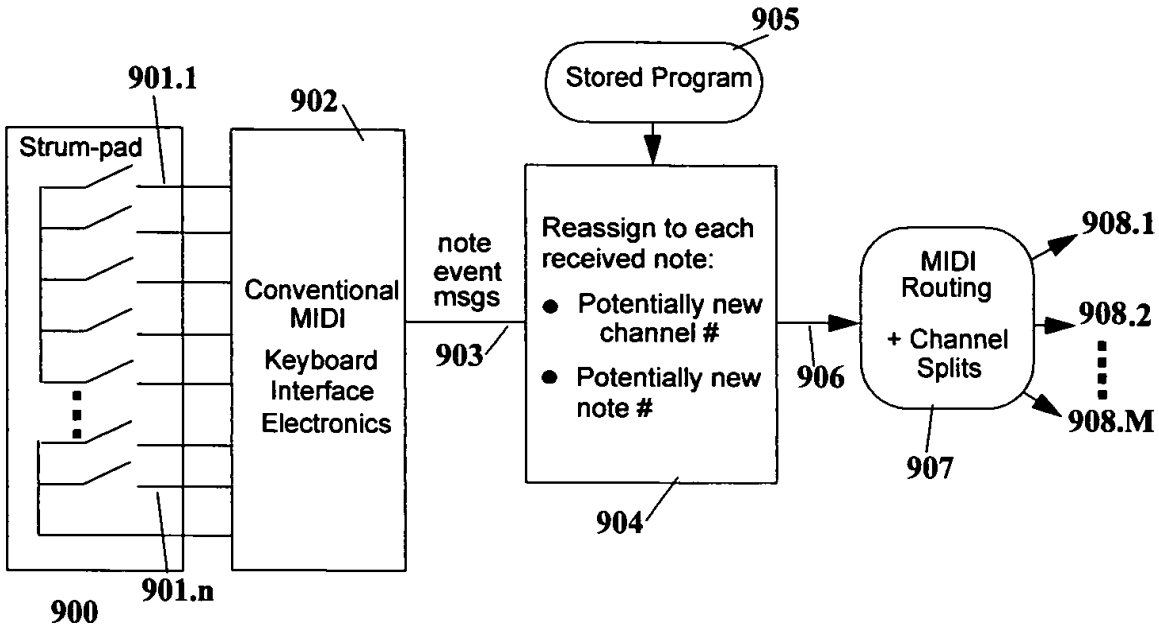

905
Stored Program
901.1
902
Strum-pad
Conventional MIDI Keyboard Interface Electronics
note event msgs
903
Reassign to each received note:
• Potentially new channel #
• Potentially new note #
906
MIDI Routing
+ Channel Splits
908.1
908.2
908.M
907
904
901.n
900

Figure 10

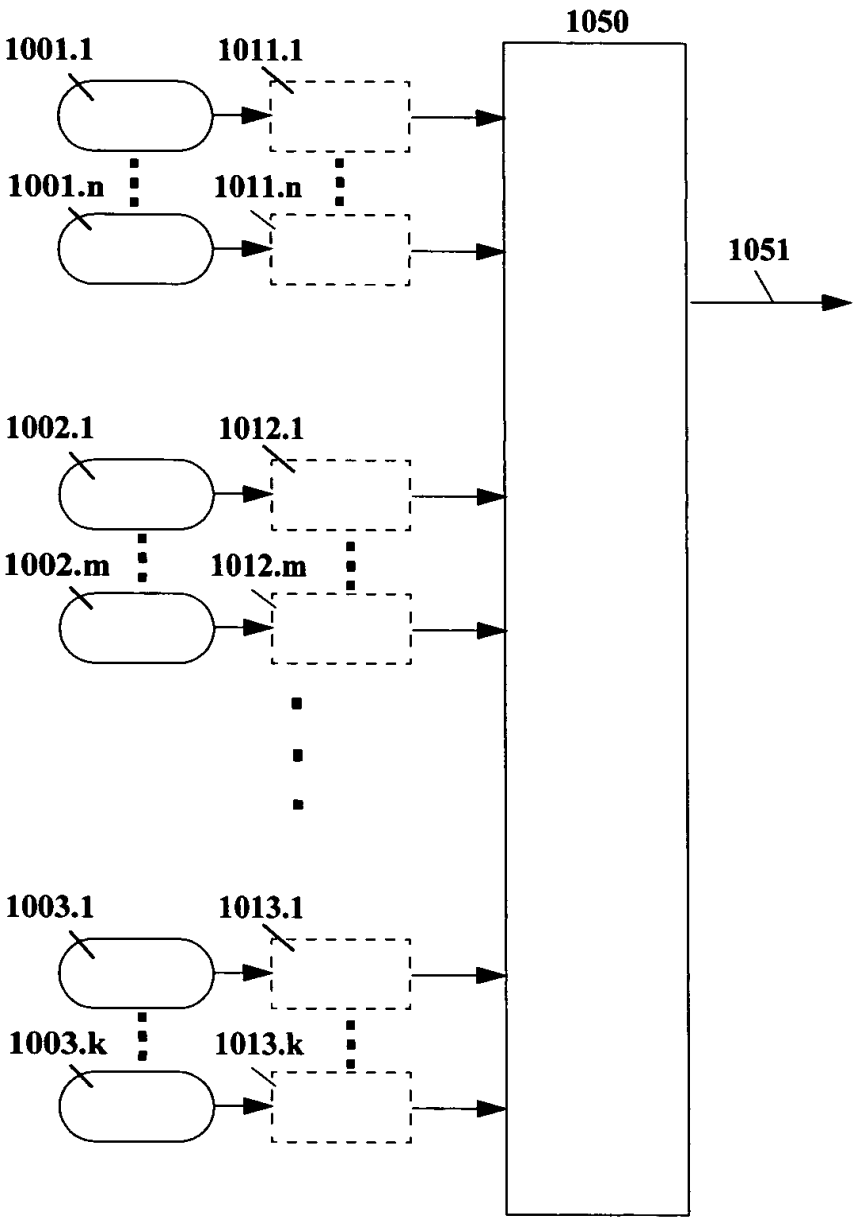

1050
1001.1
1011.1
1001.n
1011.n
1051
1002.1
1012.1
1002.m
1012.m
1003.1
1013.1
1003.k
1013.k

Figure 11

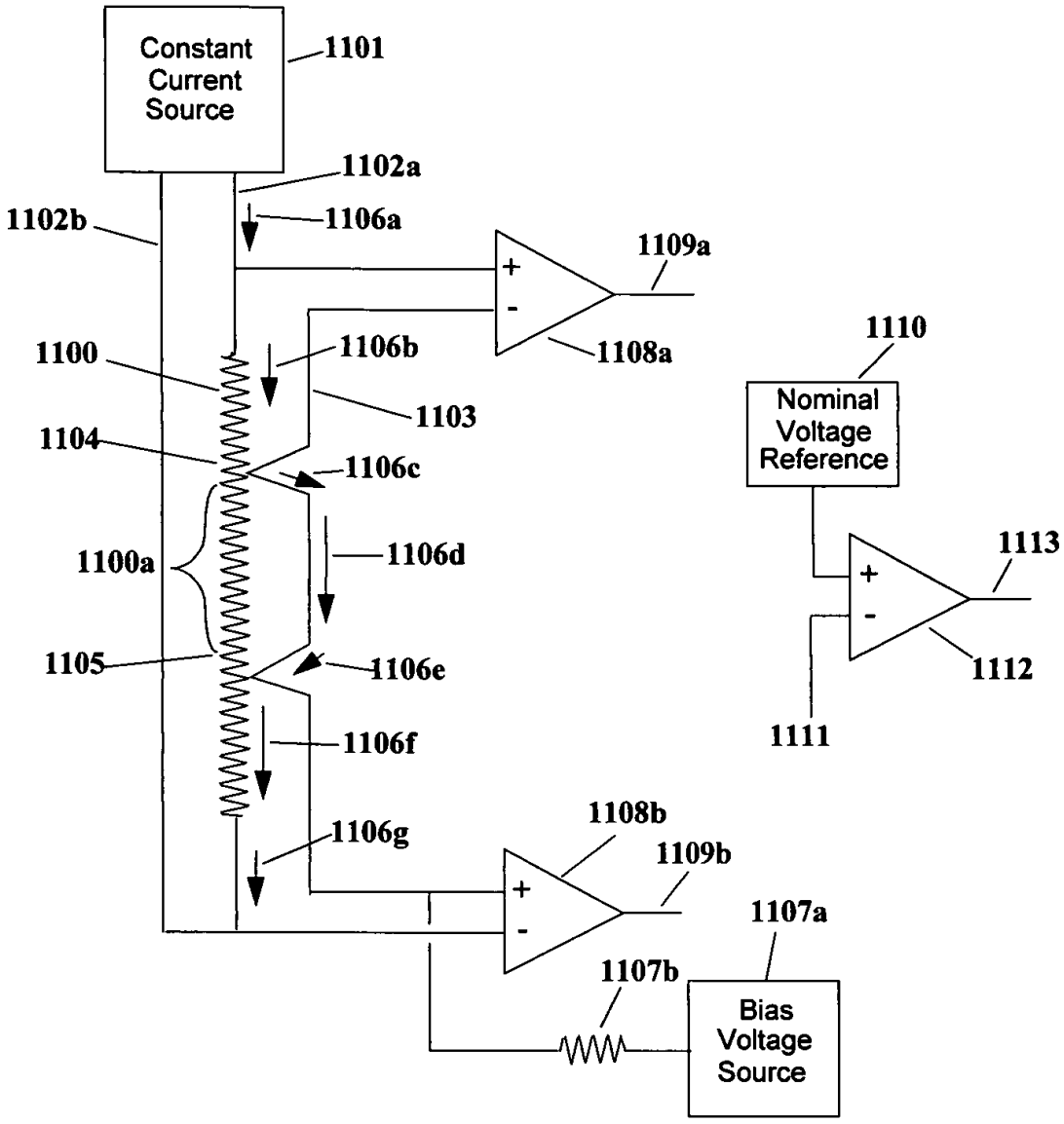

Constant Current Source
1101
1102a
1102b
1106a
1109a
1108a
1100
1106b
1103
1104
1106c
1100a
1106d
1105
1106e
1106f
1106g
1108b
1109b
1107a
1107b
Bias Voltage Source
1110
Nominal Voltage Reference
1113
1112
1111

Figure 12

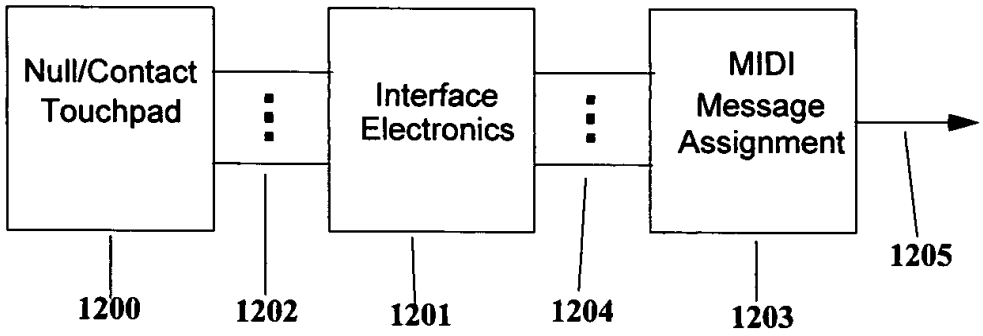

Null/Contact Touchpad
Interface Electronics
MIDI Message Assignment
1200
1202
1201
1204
1203
1205

Figure 13

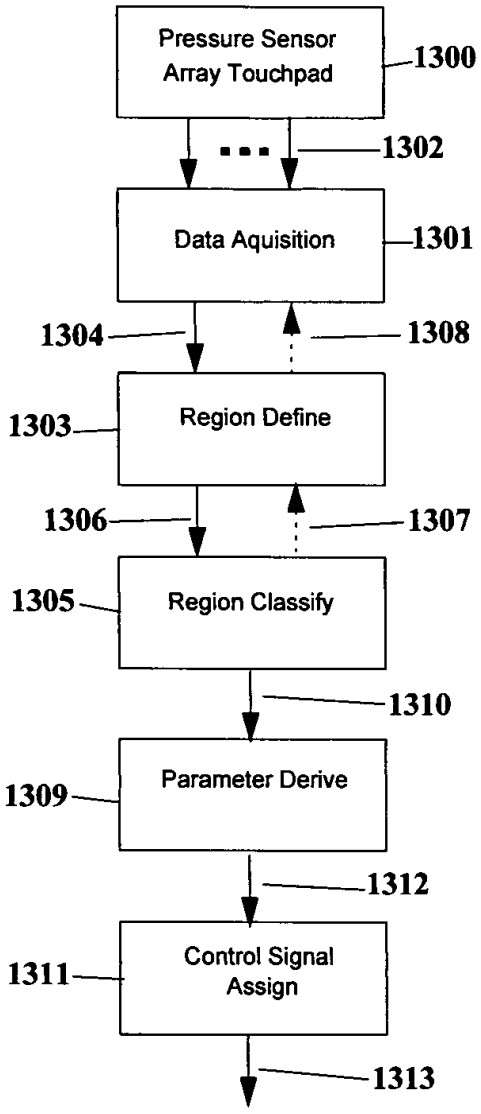

Pressure Sensor Array Touchpad
1300
1302
Data Aquisition
1301
1304
1308
1303
Region Define
1306
1307
1305
Region Classify
1310
1309
Parameter Derive
1312
1311
Control Signal Assign
1313

Figure 14

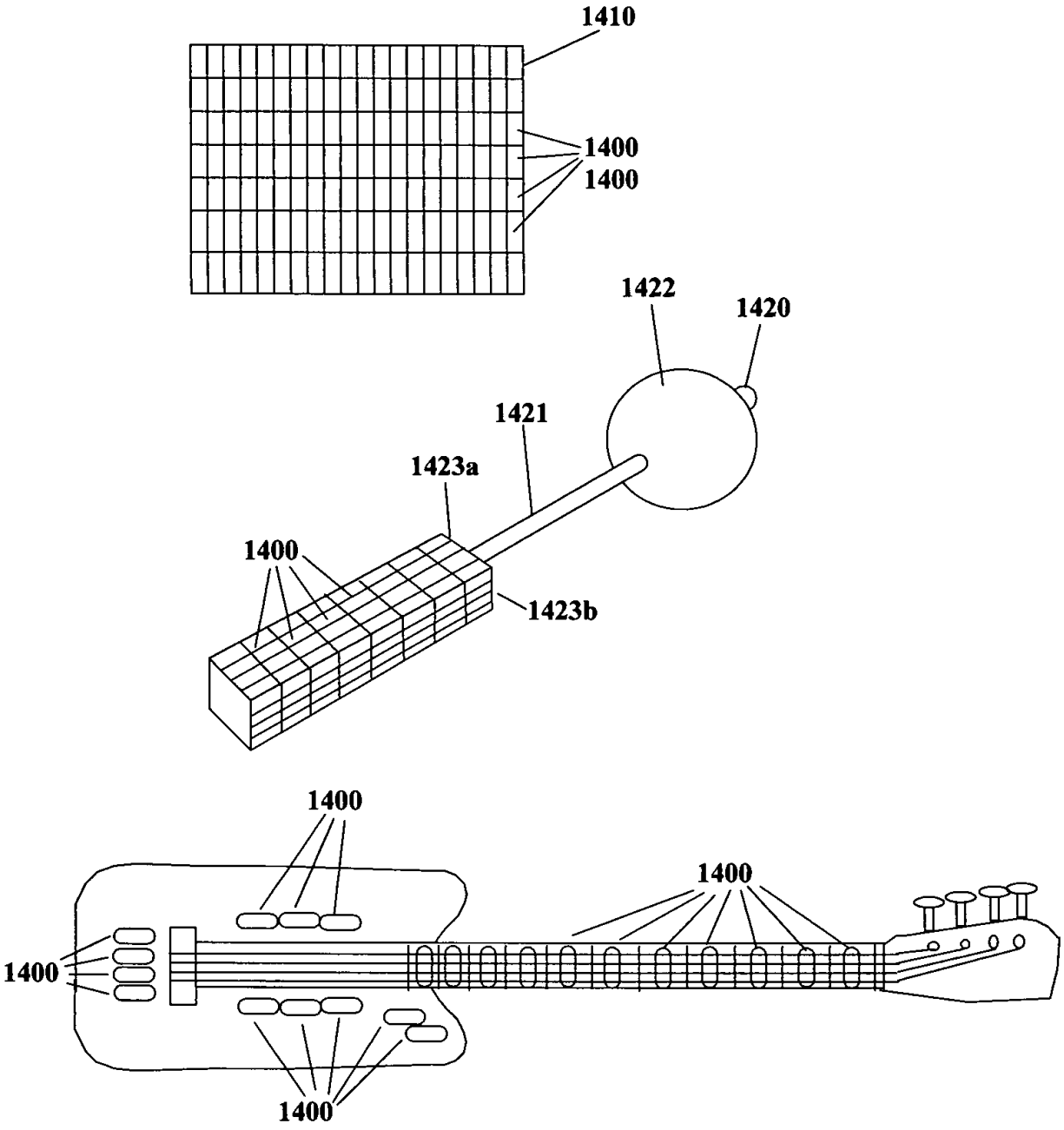

1410
1400
1400
1422
1420
1421
1423a
1400
1423b
1400
1400
1400
1400

Figure 15

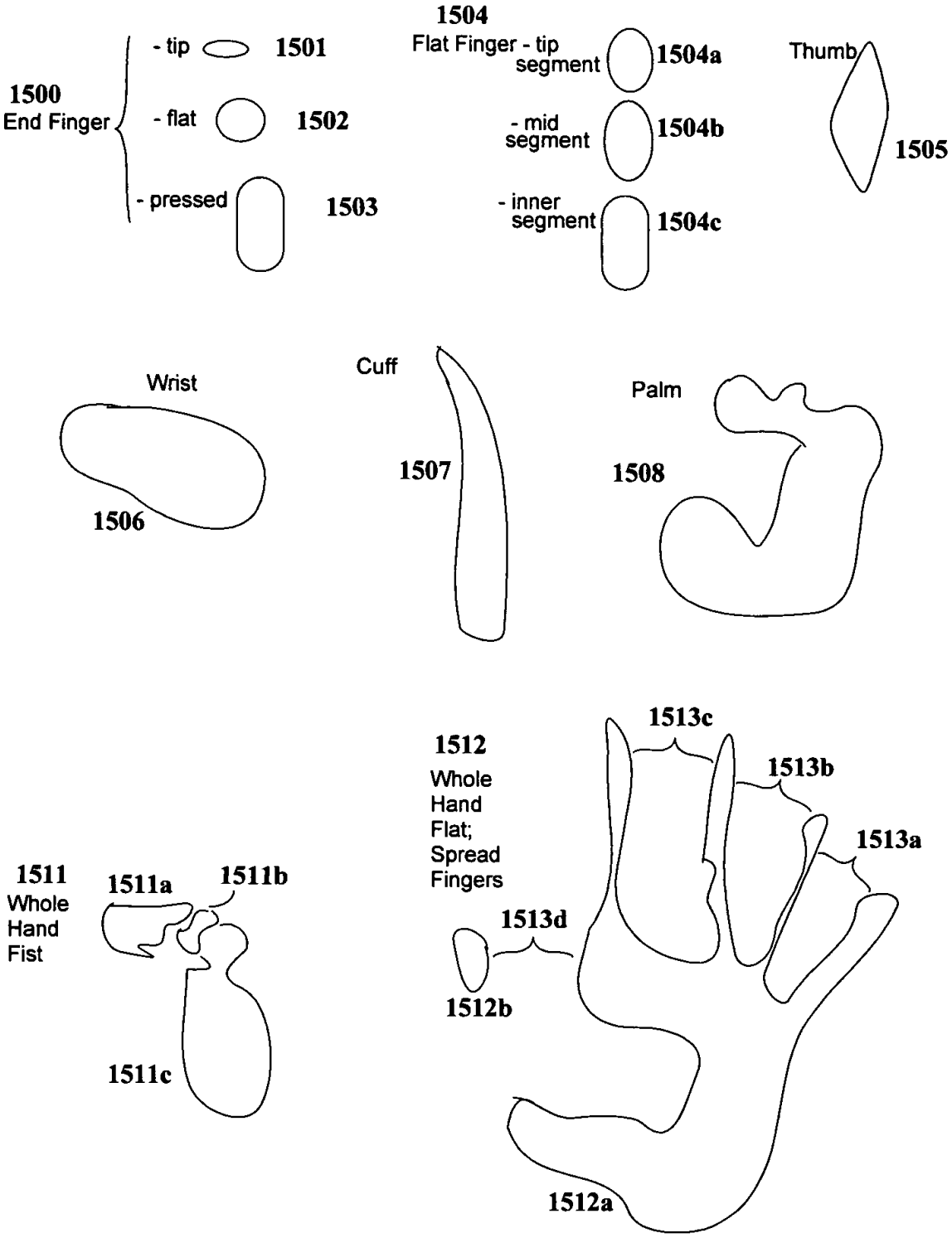

1500
End Finger
- tip
1501
- flat
1502
- pressed
1503
1504
Flat Finger - tip segment
1504a
- mid segment
1504b
- inner segment
1504c
Thumb
1505
Wrist
1506
Cuff
1507
Palm
1508
1511
Whole Hand Fist
1511a
1511b
1511c
1512
Whole Hand Flat; Spread Fingers
1513c
1513b
1513a
1513d
1512b
1512a

Figure 16

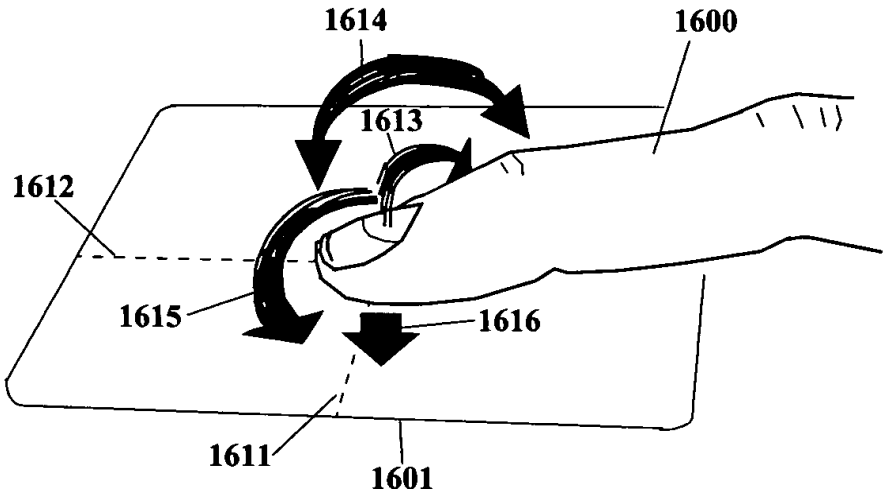
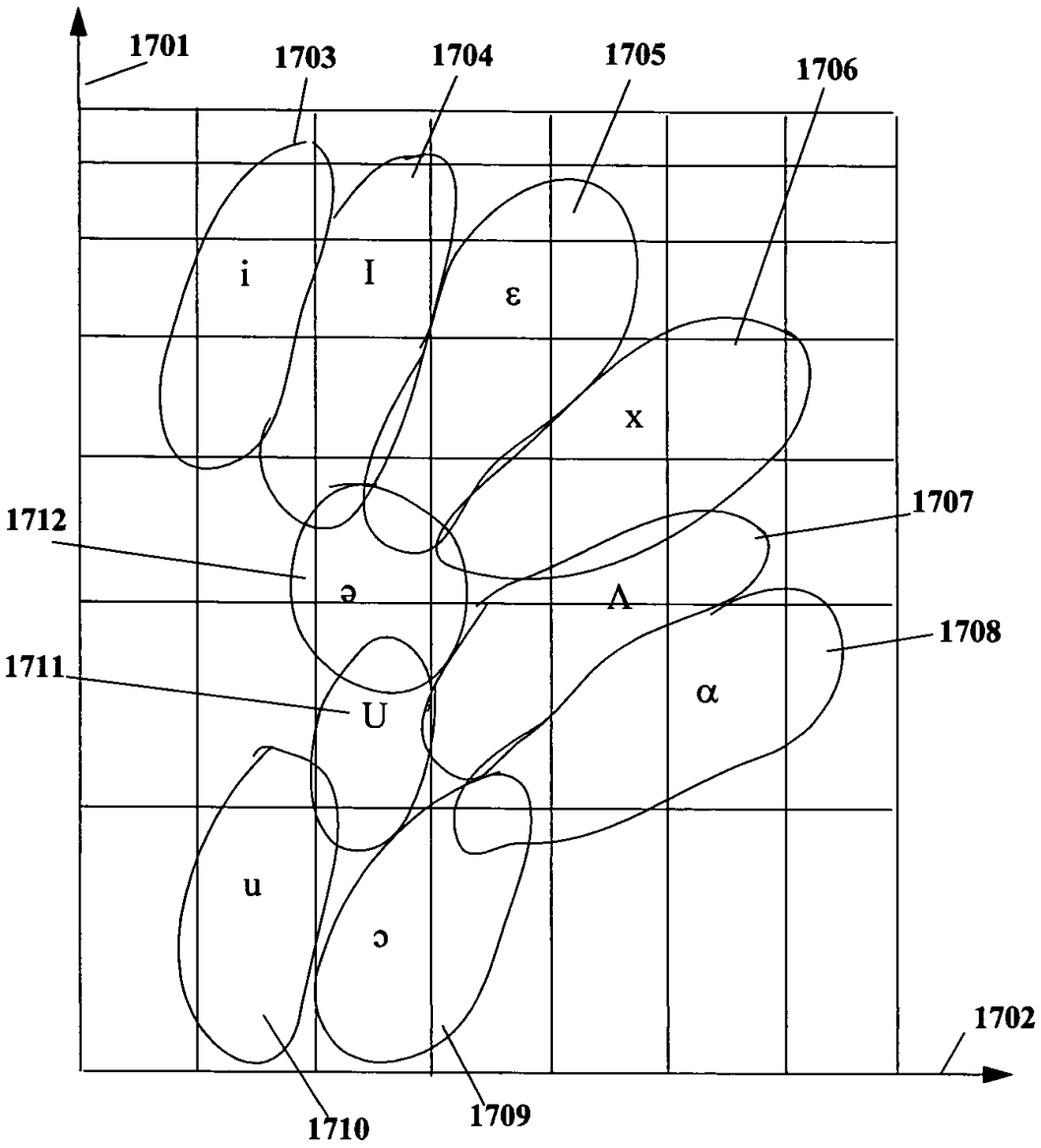


Figure 17


1701
1703
1704
1705
1706
i
I
ɛ
x
1712
1707
ə
ʌ
1708
1711
U
ɑ
u
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1702
1710
1709

Figure 18

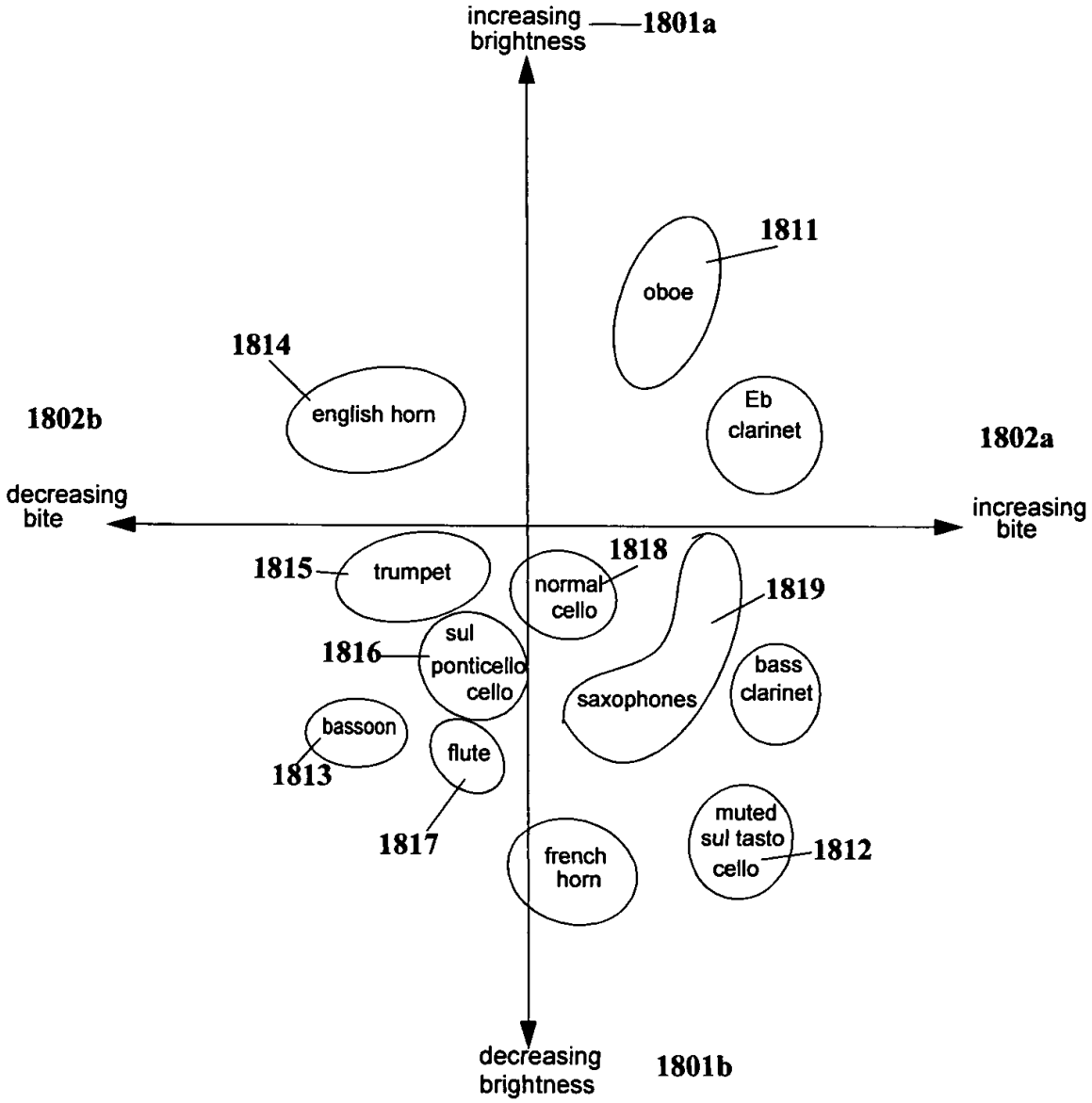
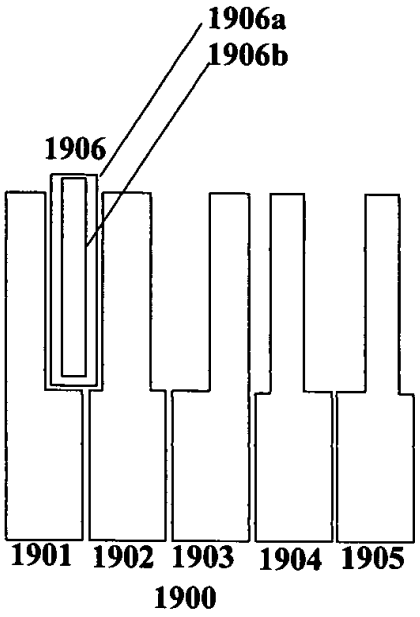
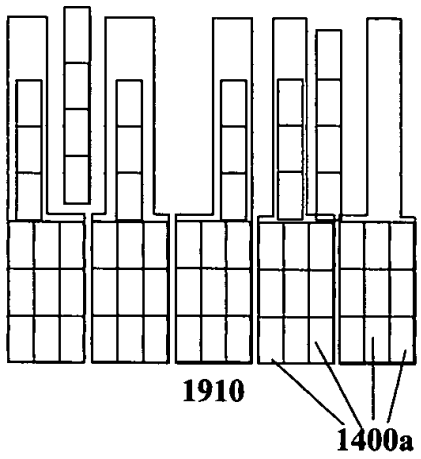
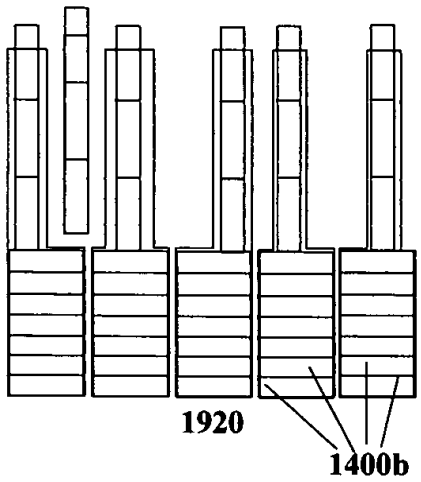

increasing brightness
1801a
1811
oboe
1814
english horn
1802b
Eb clarinet
1802a
decreasing bite
increasing bite
1815
trumpet
1818
normal cello
1819
1816
sul ponticello cello
saxophones
bass clarinet
bassoon
1813
flute
1817
muted sul tasto cello
1812
french horn
decreasing brightness
1801b

Figure 19


1906a
1906b
1906
1901
1902
1903
1904
1905
1900


1910
1400a


1920
1400b

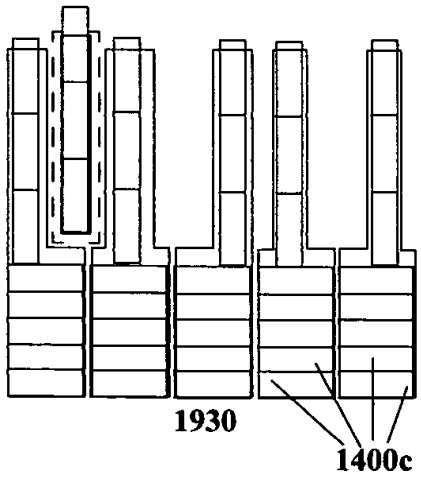

1930
1400c

Figure 20

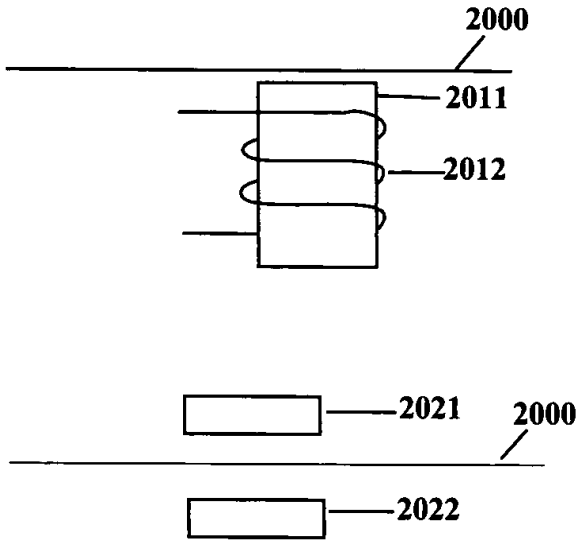

2000
2011
2012
2021
2000
2022
2000
2032
2031
2000
2043
2041
2042

Figure 21

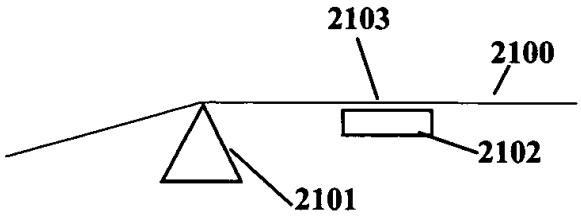


Figure 22

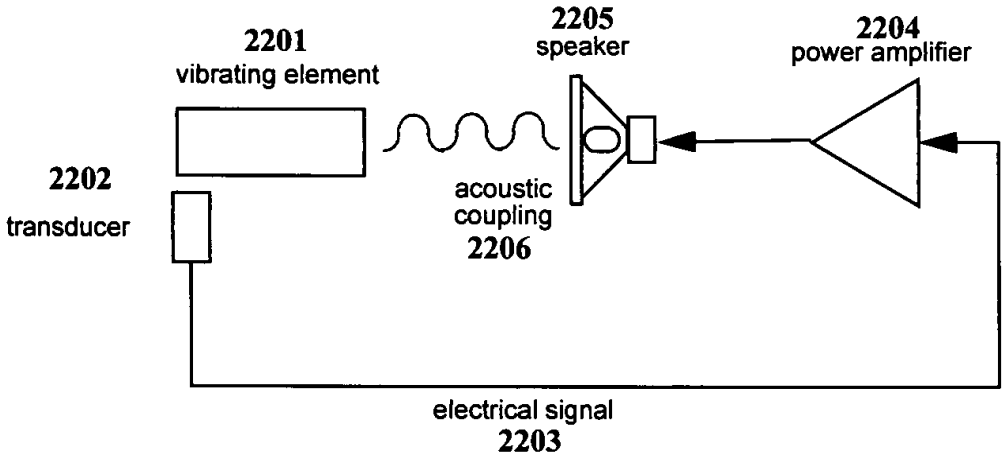

2201
vibrating element
2205
speaker
2204
power amplifier
2202
transducer
acoustic
coupling
2206
electrical signal
2203

Figure 23

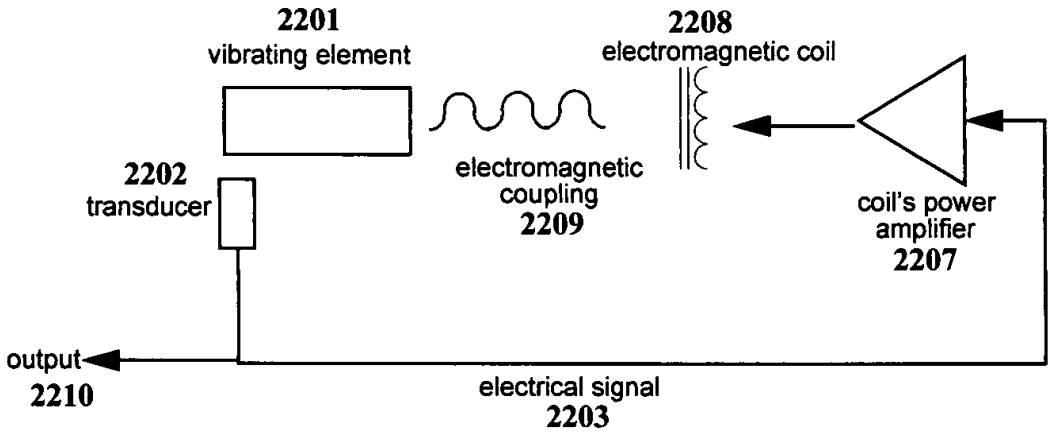
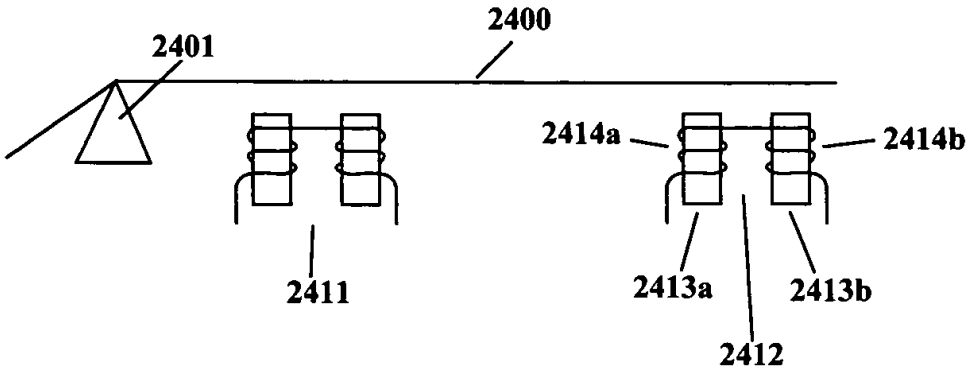

2201
vibrating element
2208
electromagnetic coil
2202
transducer
electromagnetic
coupling
2209
coil's power
amplifier
2207
output
2210
electrical signal
2203

Figure 24


2400
2401
2414a
2414b
2411
2413a
2413b
2412

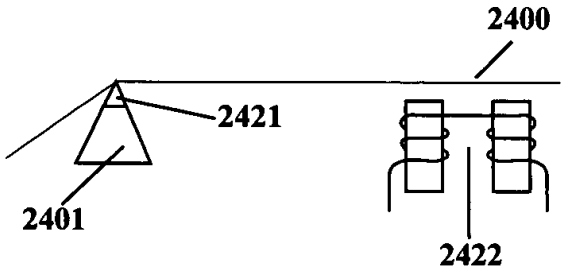

2400
2421
2401
2422

Figure 25

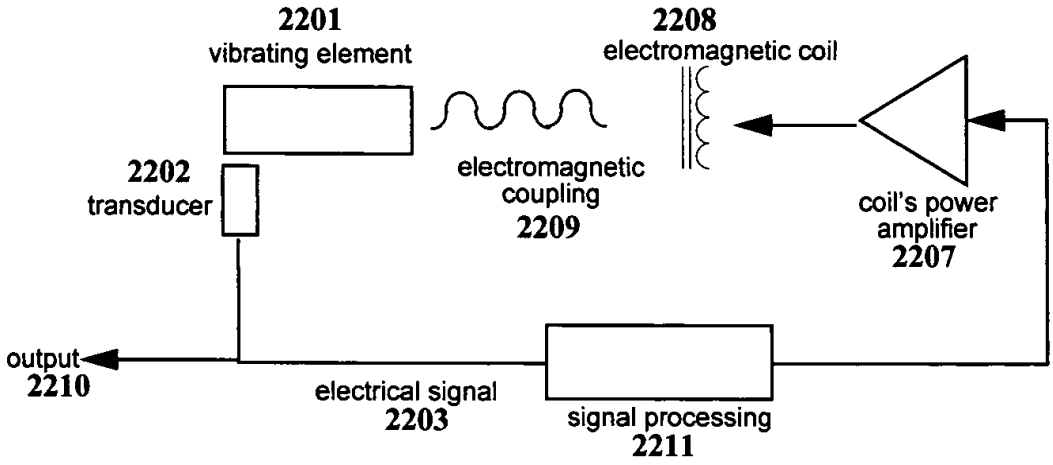

2201
vibrating element
2208
electromagnetic coil
2202
transducer
electromagnetic
coupling
2209
coil's power
amplifier
2207
output
2210
electrical signal
2203
signal processing
2211

Figure 26

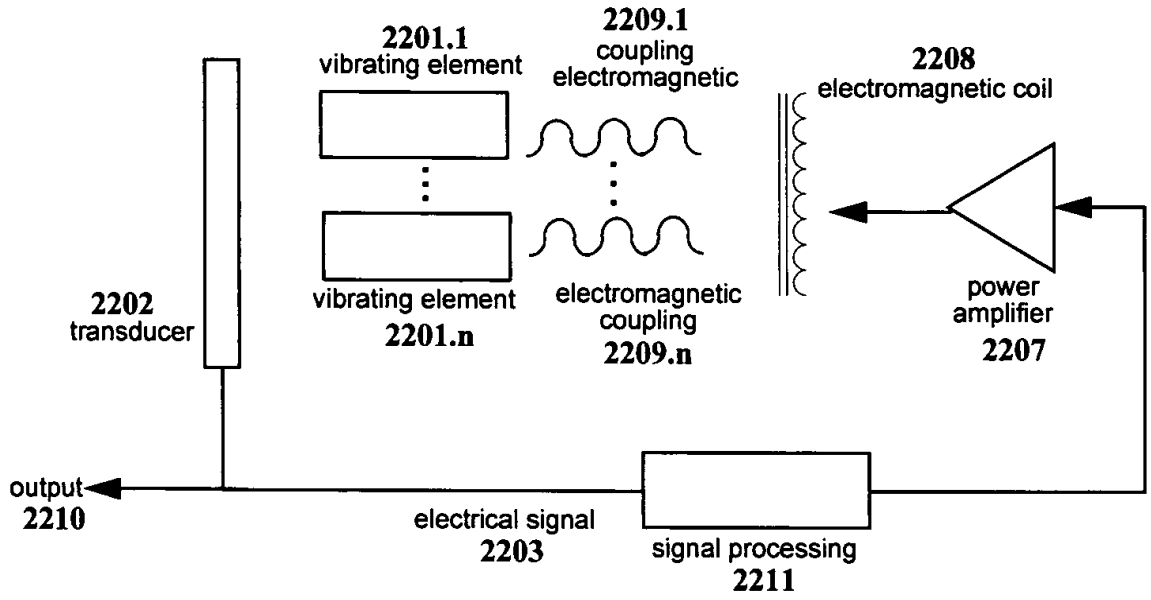

2201.1
vibrating element
2209.1
coupling
electromagnetic
2208
electromagnetic coil
2202
transducer
vibrating element
2201.n
electromagnetic
coupling
2209.n
power
amplifier
2207
output
2210
electrical signal
2203
signal processing
2211

Figure 27

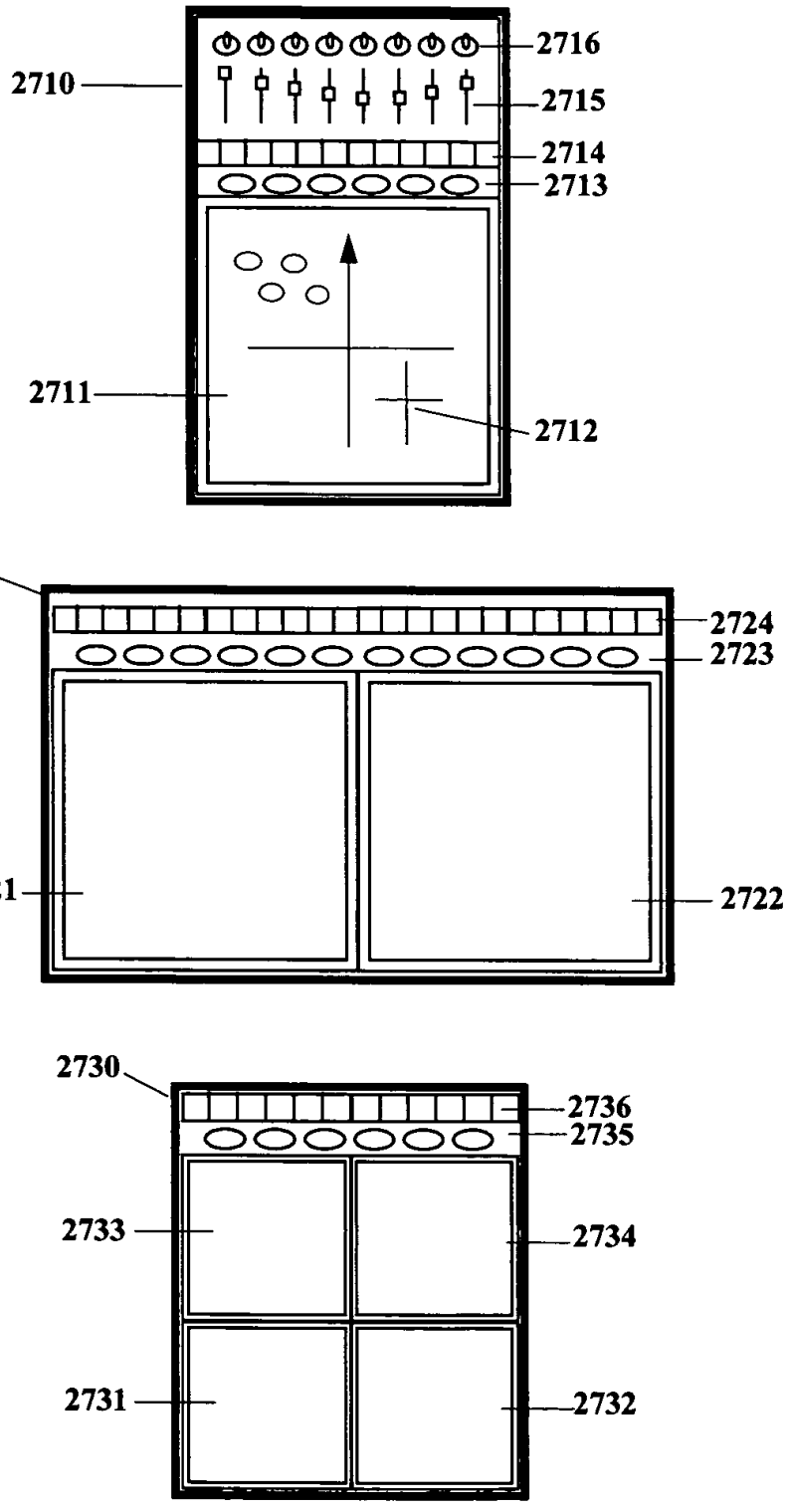

2710
2716
2715
2714
2713
2711
2712
2720
2724
2723
2721
2722
2730
2736
2735
2733
2734
2731
2732

Figure 28

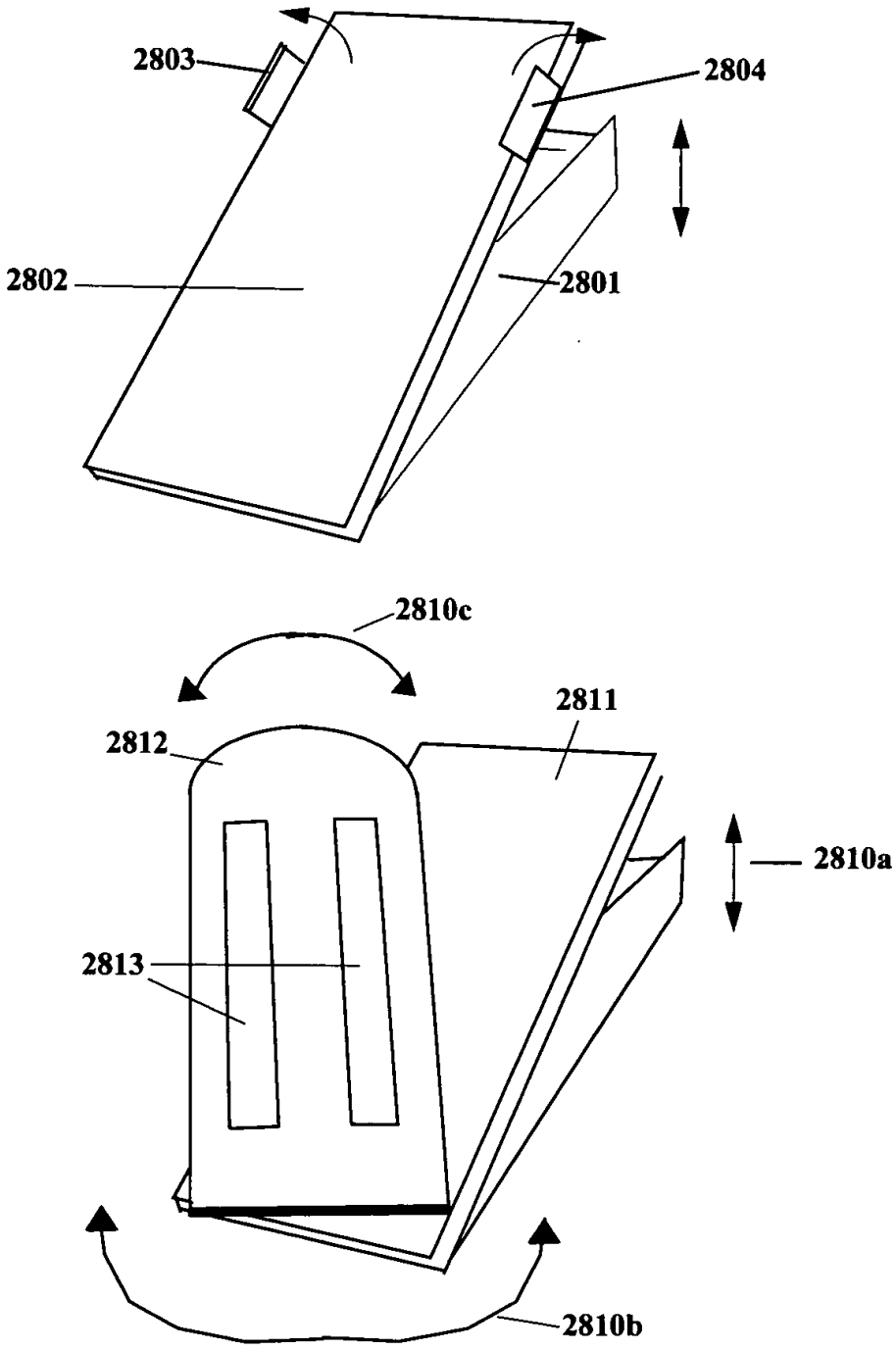
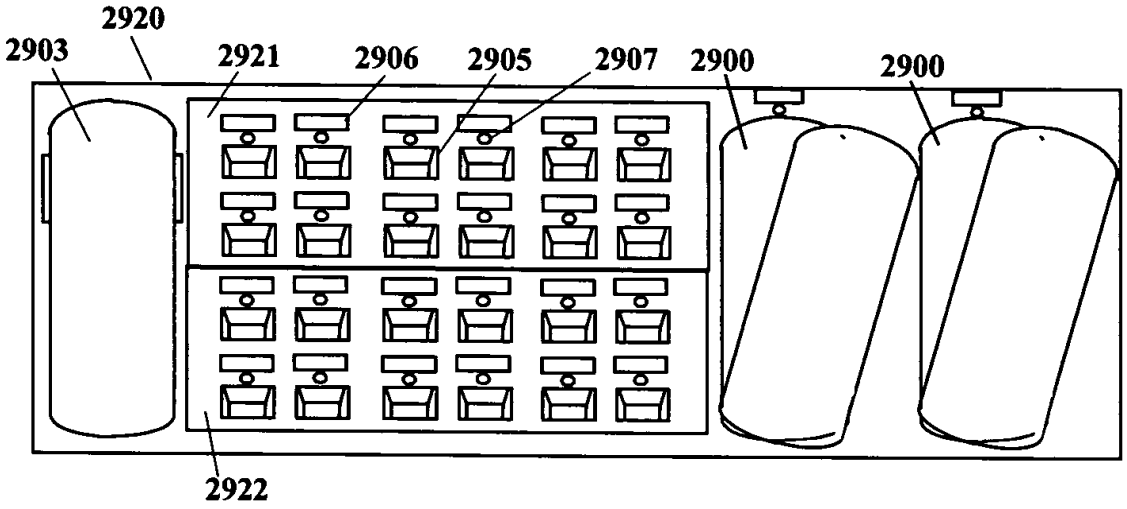


Figure 29


2920
2903
2921
2906
2905
2907
2900
2900
2922

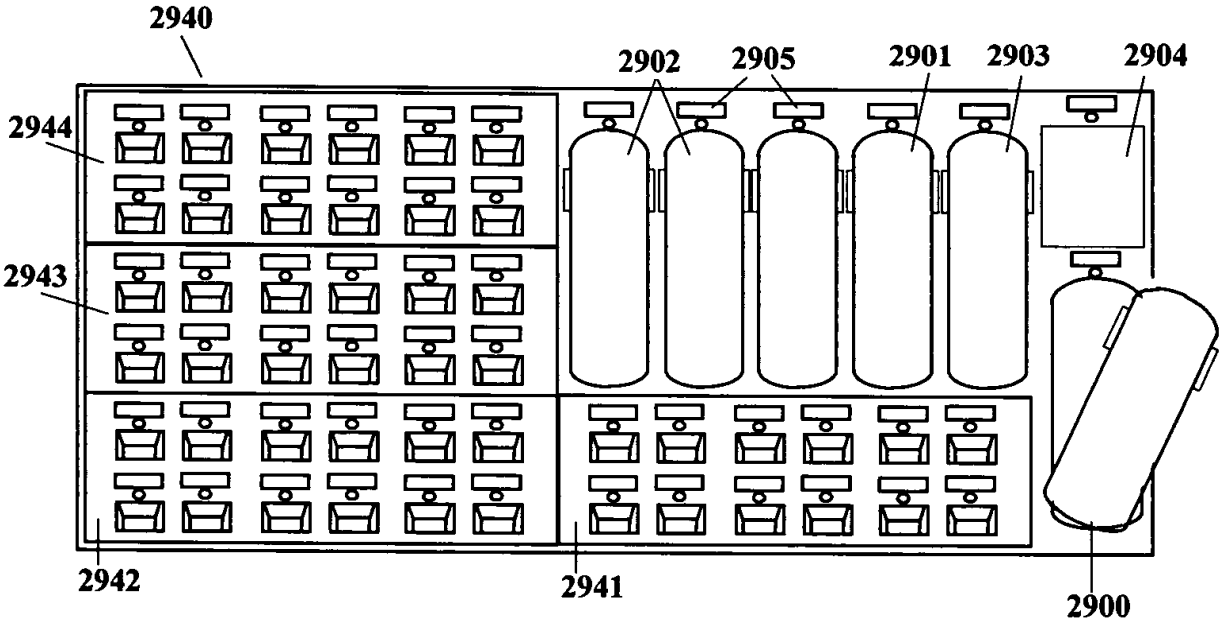

2940
2902
2905
2901
2903
2904
2944
2943
2942
2941
2900

Figure 30

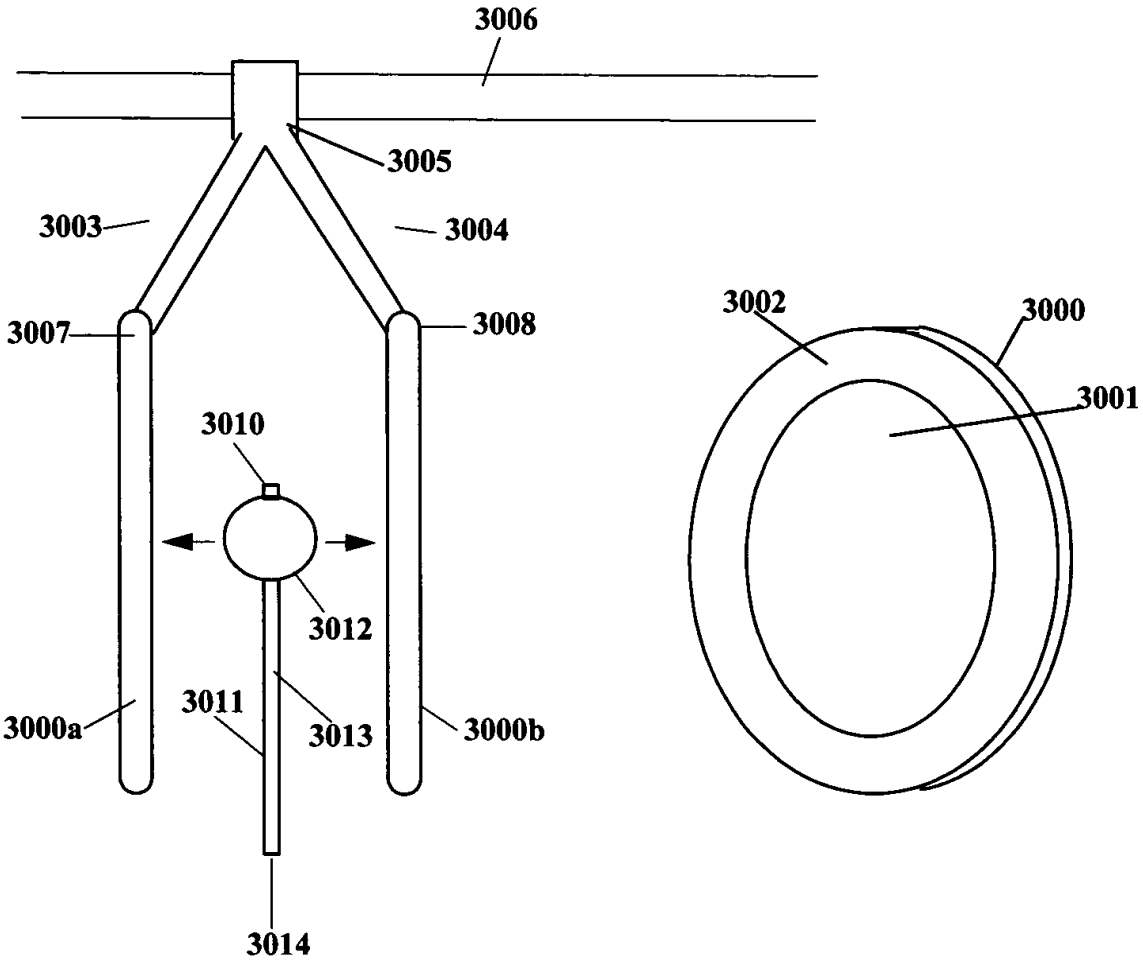

3006
3005
3003
3004
3007
3008
3010
3012
3011
3013
3000a
3000b
3014
3002
3000
3001

Figure 31

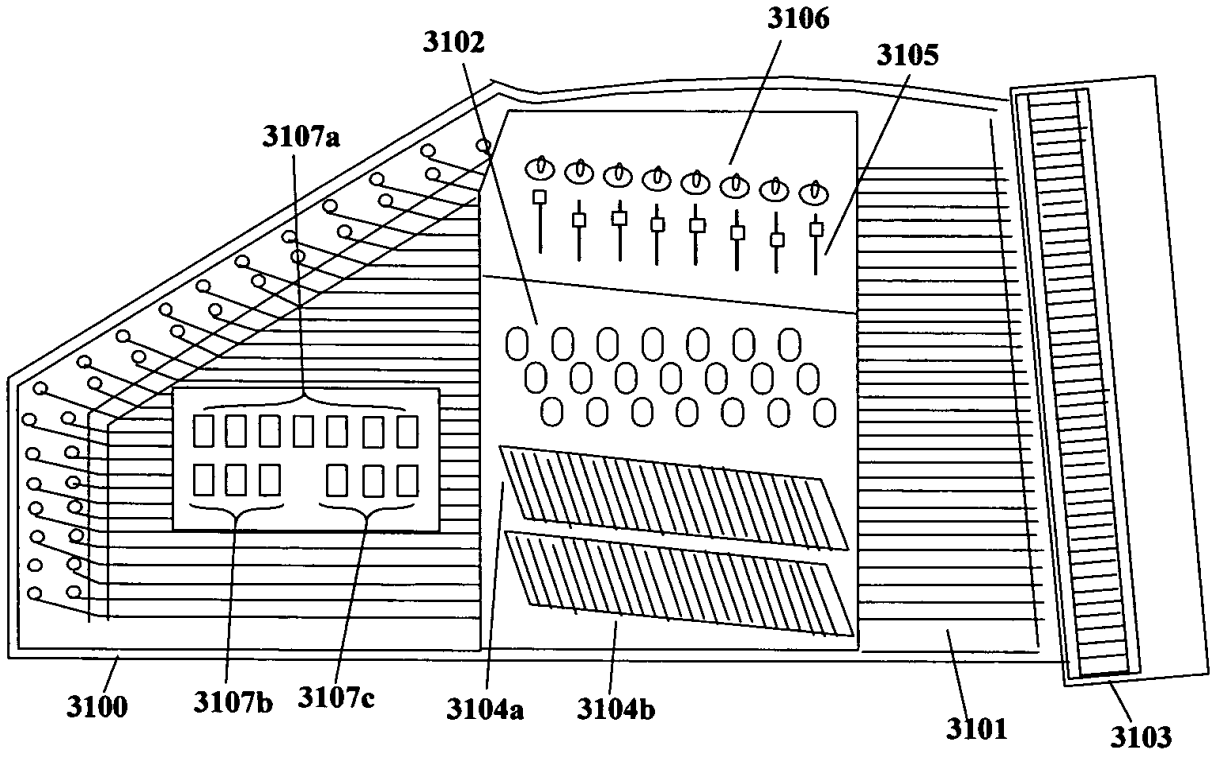


Figure 32

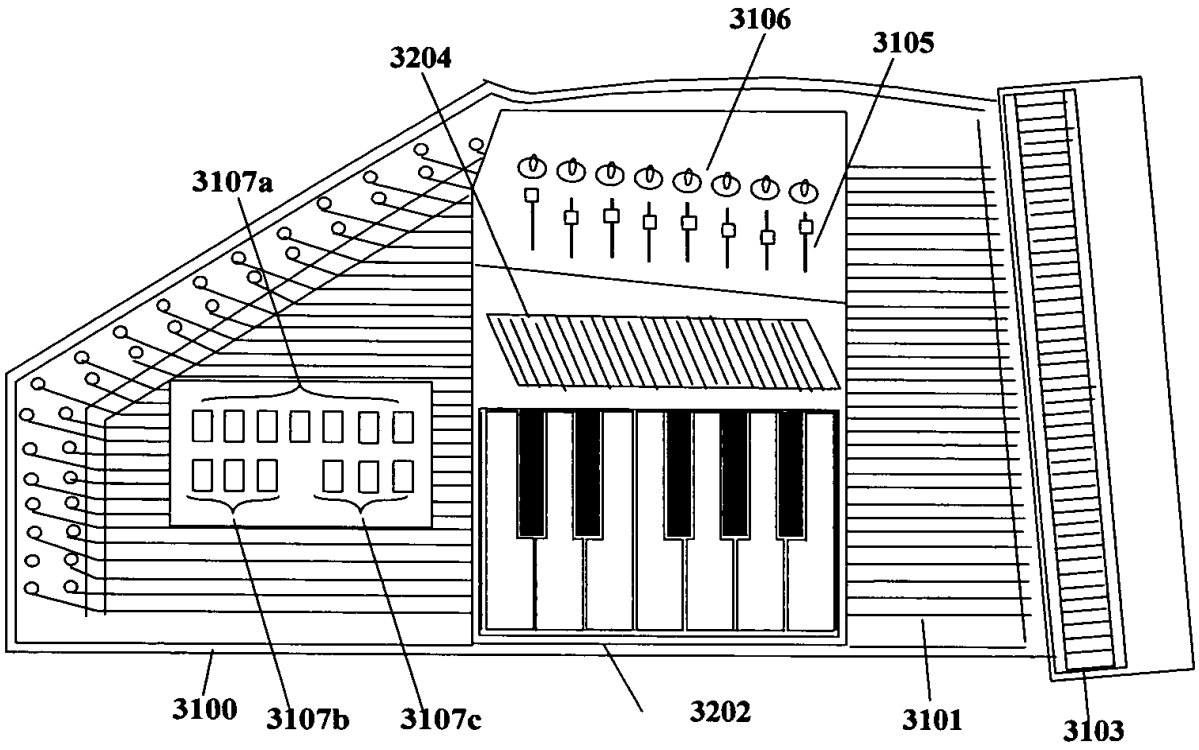


Figure 33

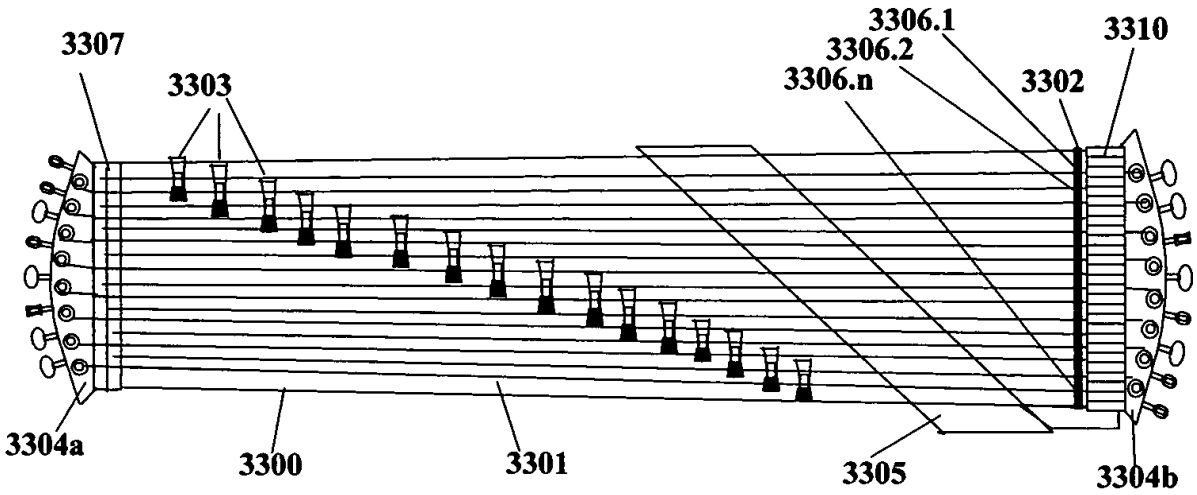

3307
3303
3306.1
3306.2
3306.n
3310
3302
3304a
3300
3301
3305
3304b

Figure 34

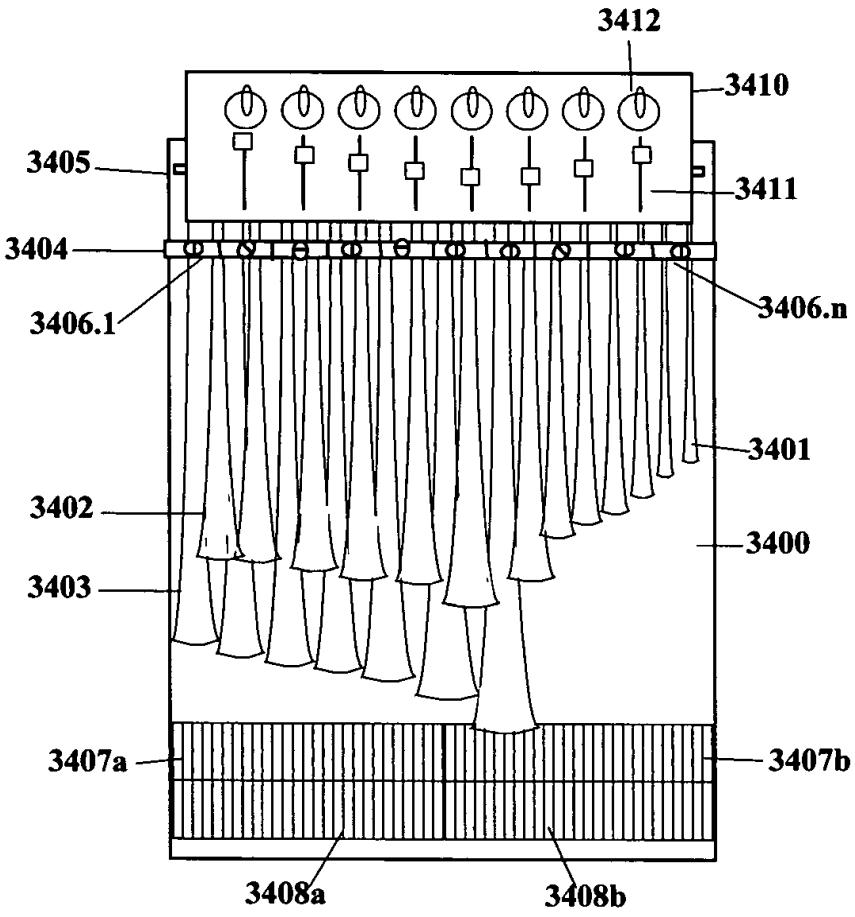

3412
3410
3405
3411
3404
3406.1
3406.n
3401
3402
3400
3403
3407a
3407b
3408a
3408b

Figure 35

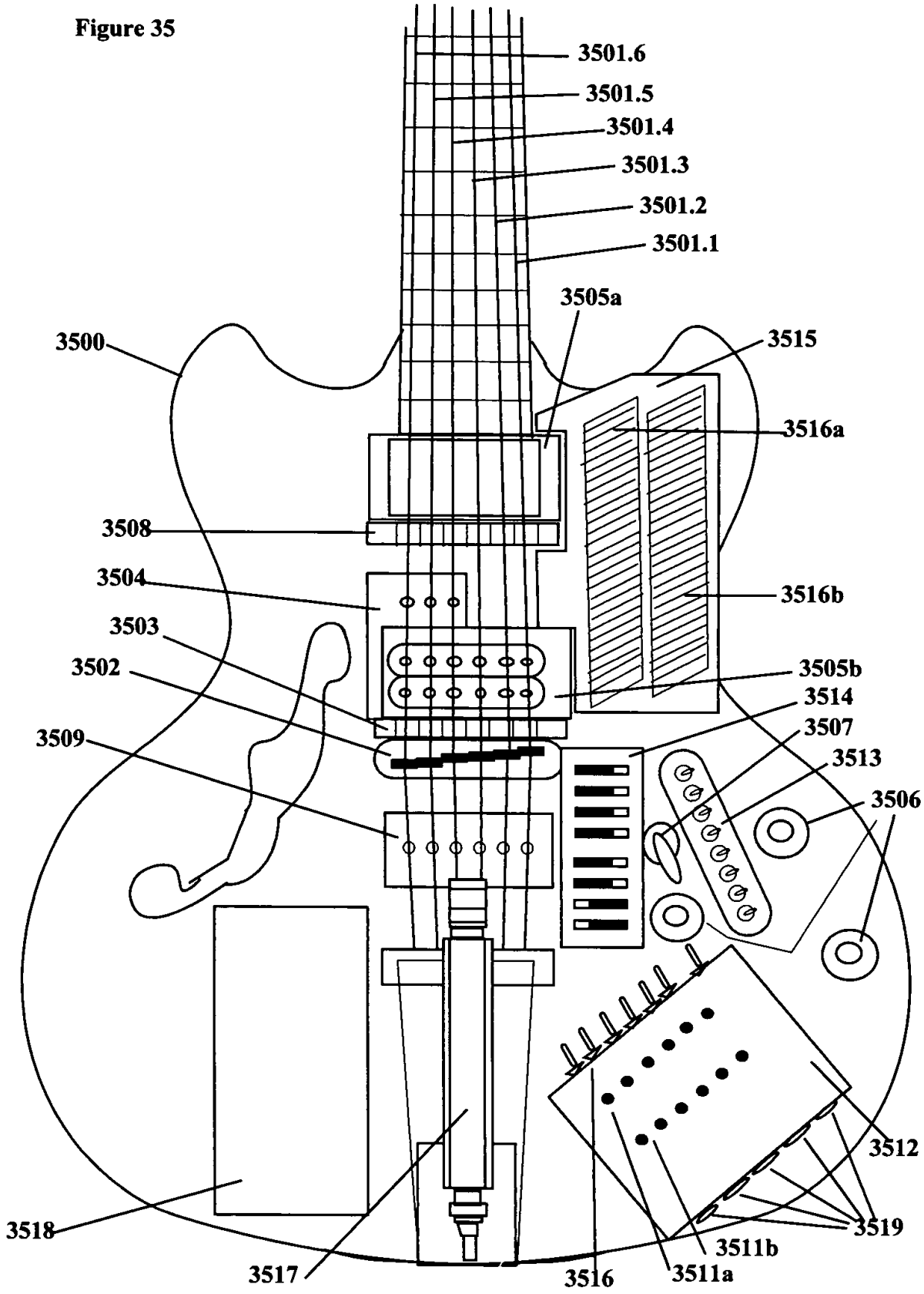

3501.6
3501.5
3501.4
3501.3
3501.2
3501.1
3505a
3500
3515
3516a
3508
3504
3516b
3503
3502
3505b
3514
3507
3509
3513
3506
3512
3518
3519
3511b
3517
3516
3511a

Figure 36

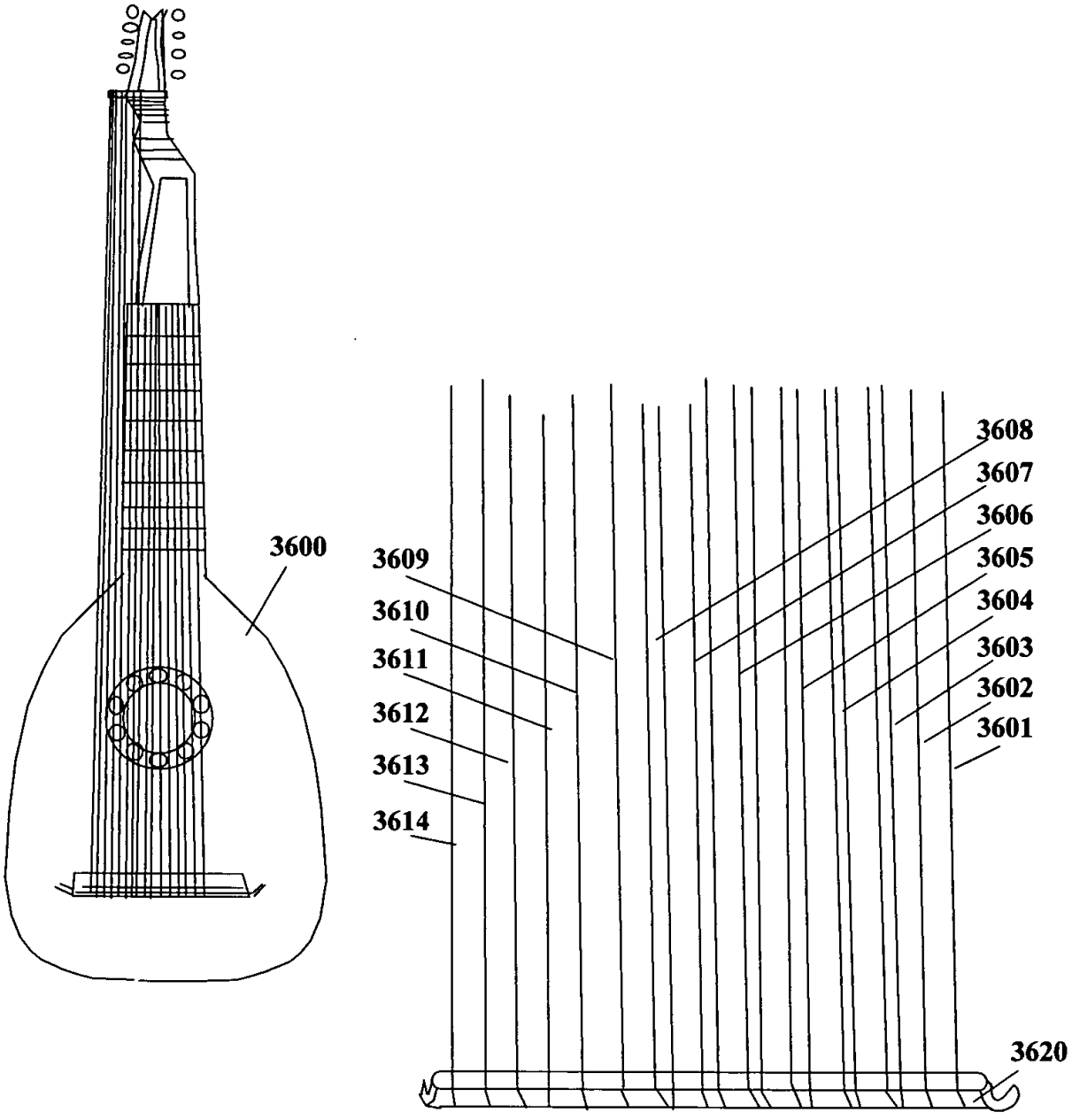

3600
3608
3607
3606
3605
3604
3603
3602
3601
3609
3610
3611
3612
3613
3614
3620

Figure 37

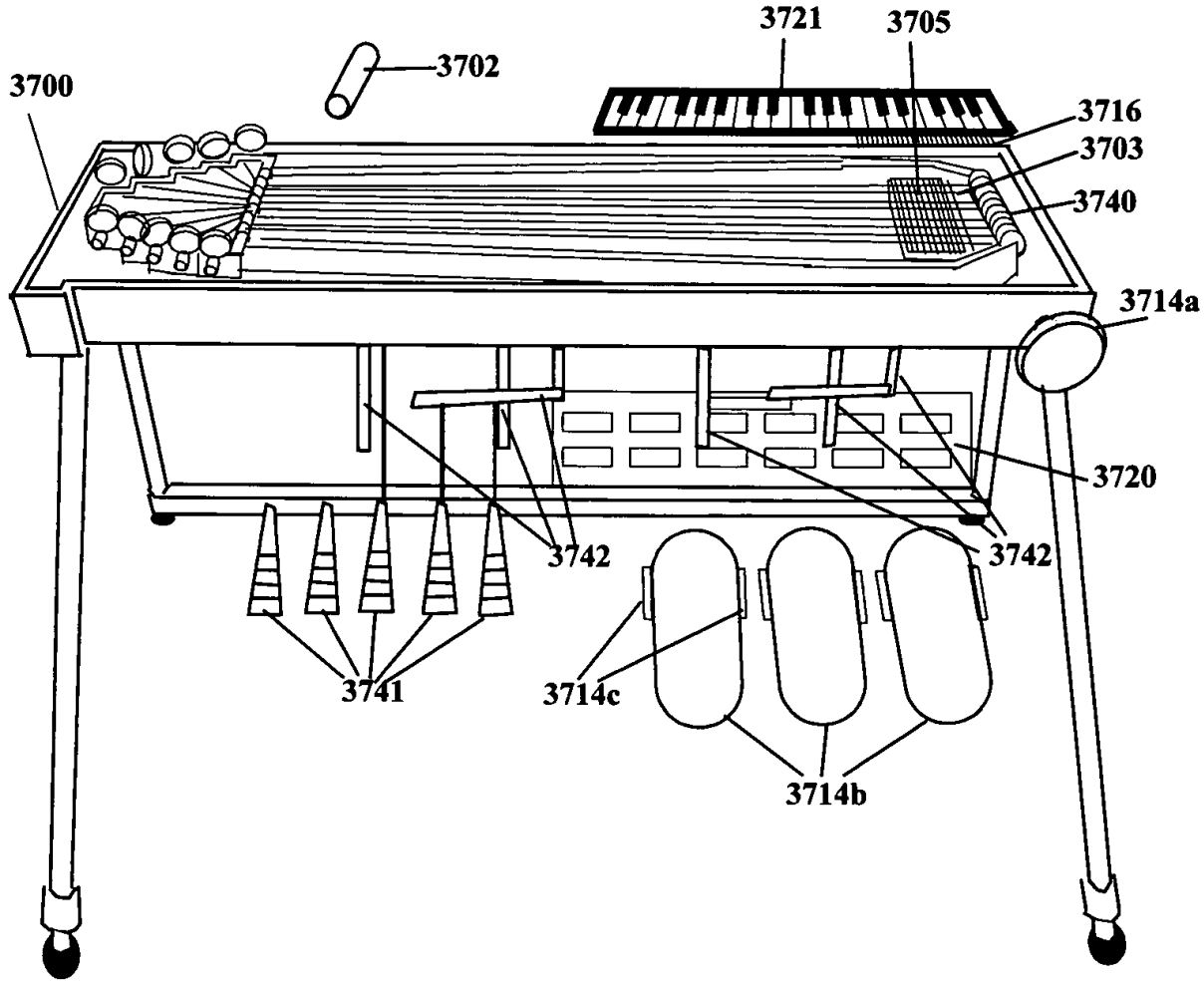

3721
3705
3702
3700
3716
3703
3740
3714a
3720
3742
3742
3741
3714c
3714b

Figure 38

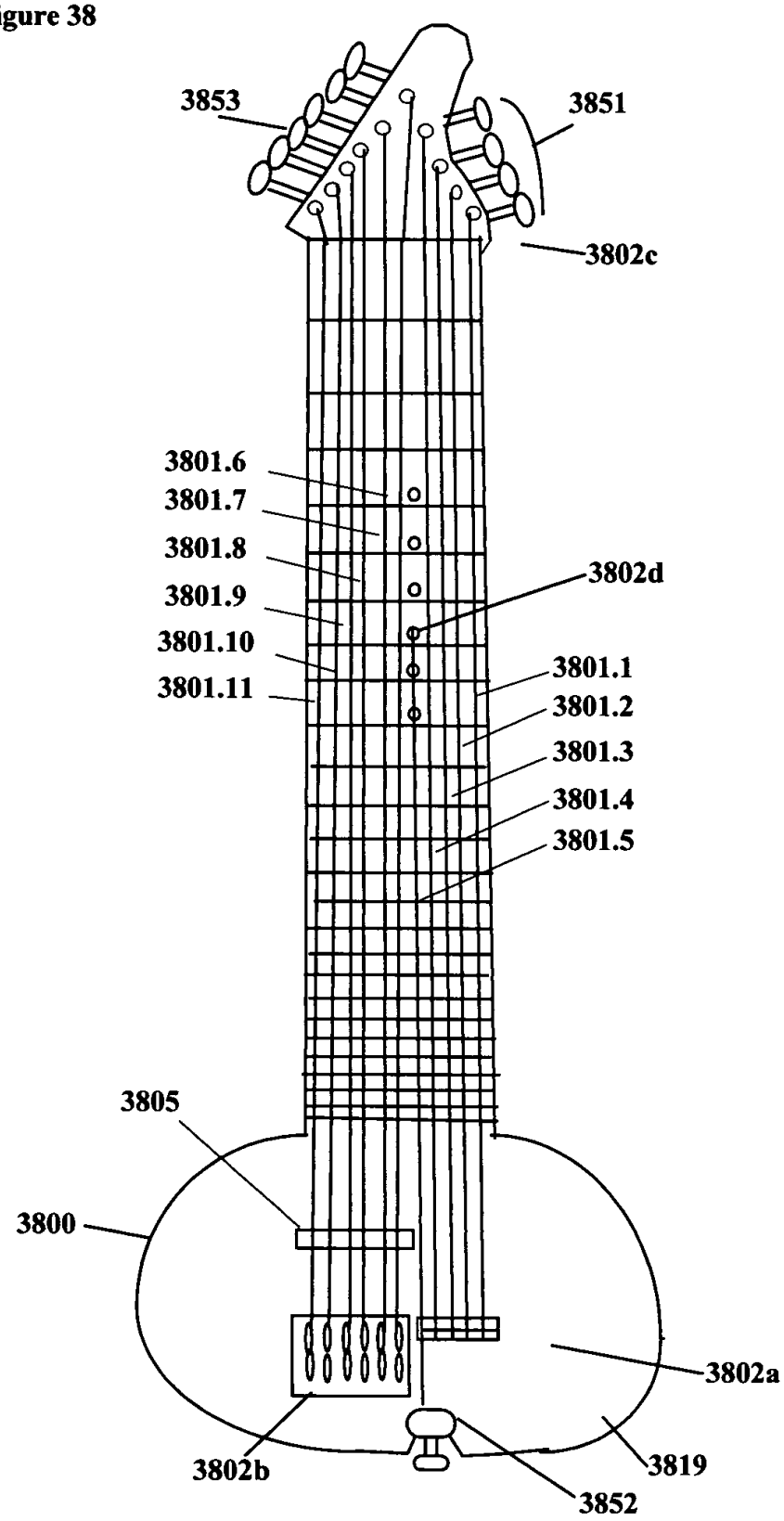

3853
3851
3802c
3801.6
3801.7
3801.8
3801.9
3801.10
3801.11
3802d
3801.1
3801.2
3801.3
3801.4
3801.5
3805
3800
3802a
3802b
3819
3852

Figure 39

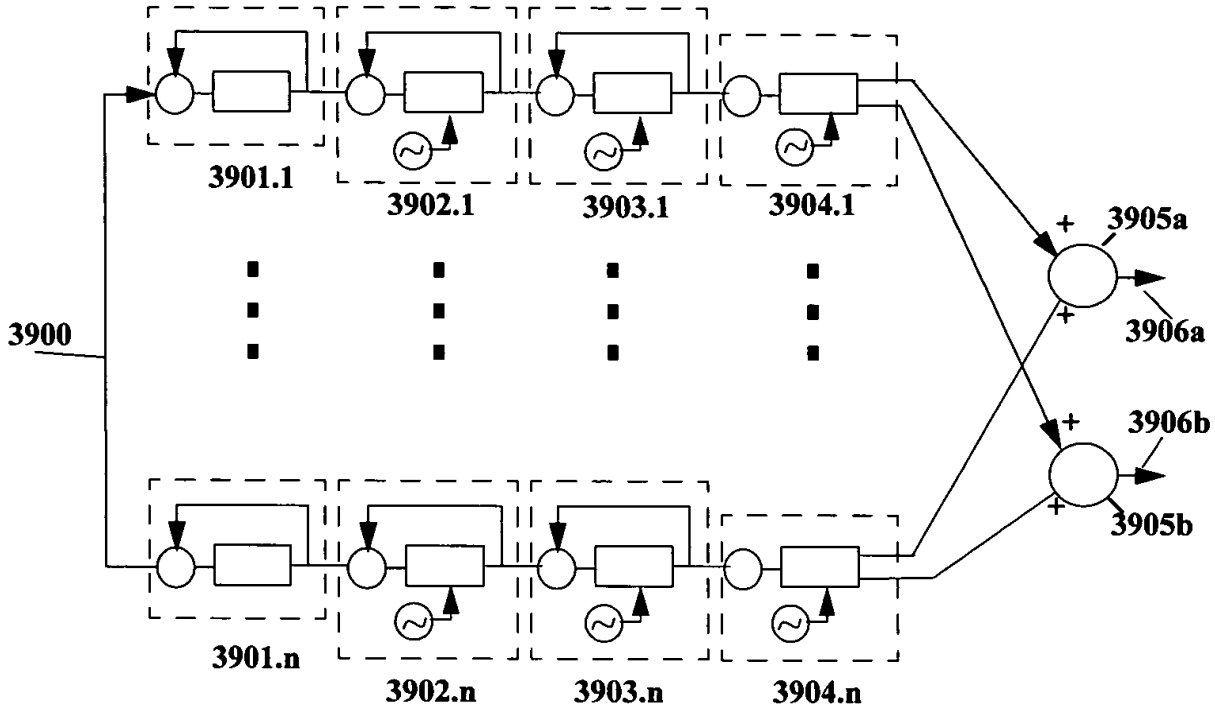

3900
3901.1
3902.1
3903.1
3904.1
3901.n
3902.n
3903.n
3904.n
3905a
3906a
3906b
3905b

Figure 40

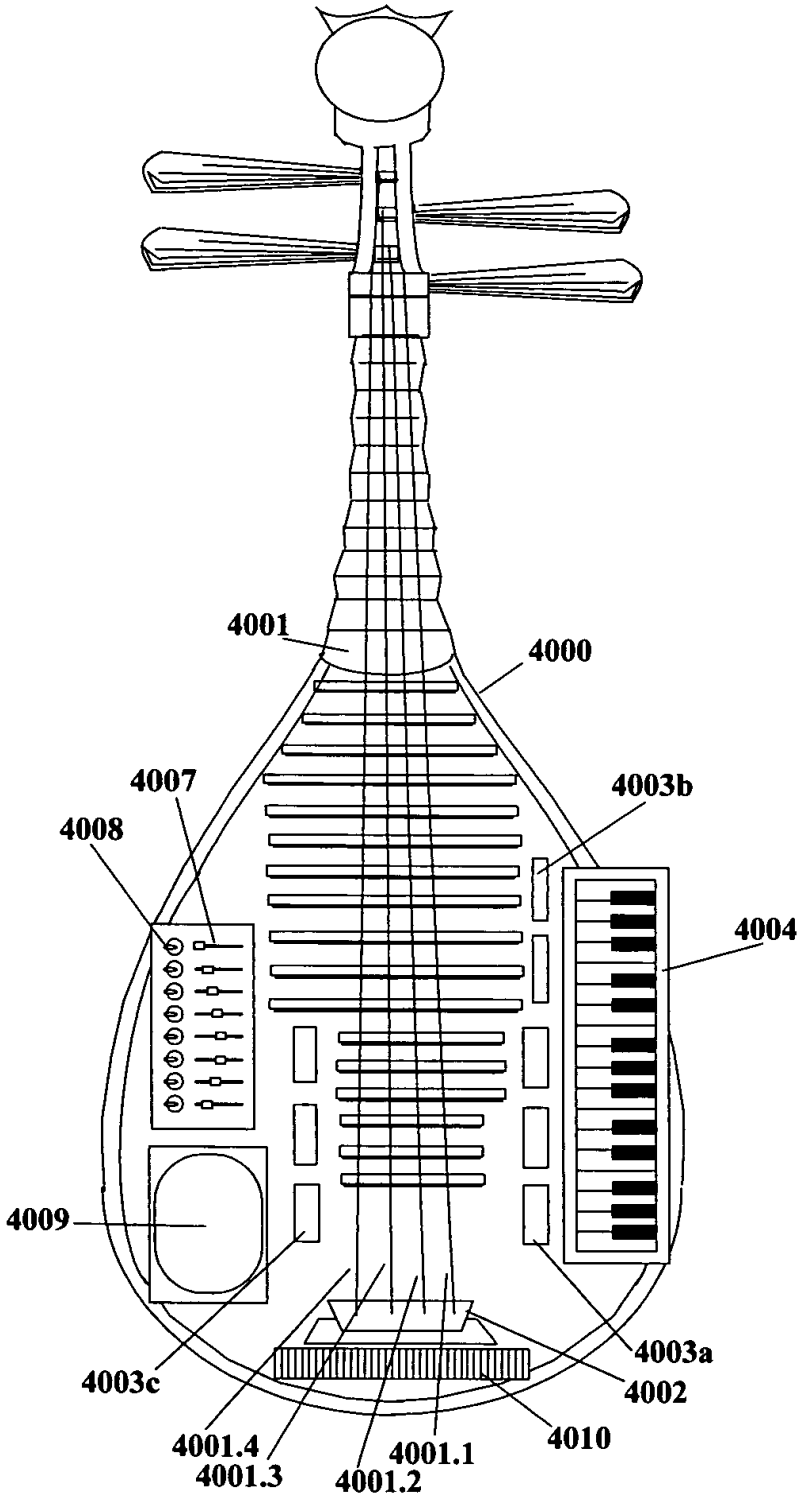

4001
4000
4007
4003b
4008
4004
4009
4003a
4003c
4002
4010
4001.4
4001.3
4001.2
4001.1

Figure 41

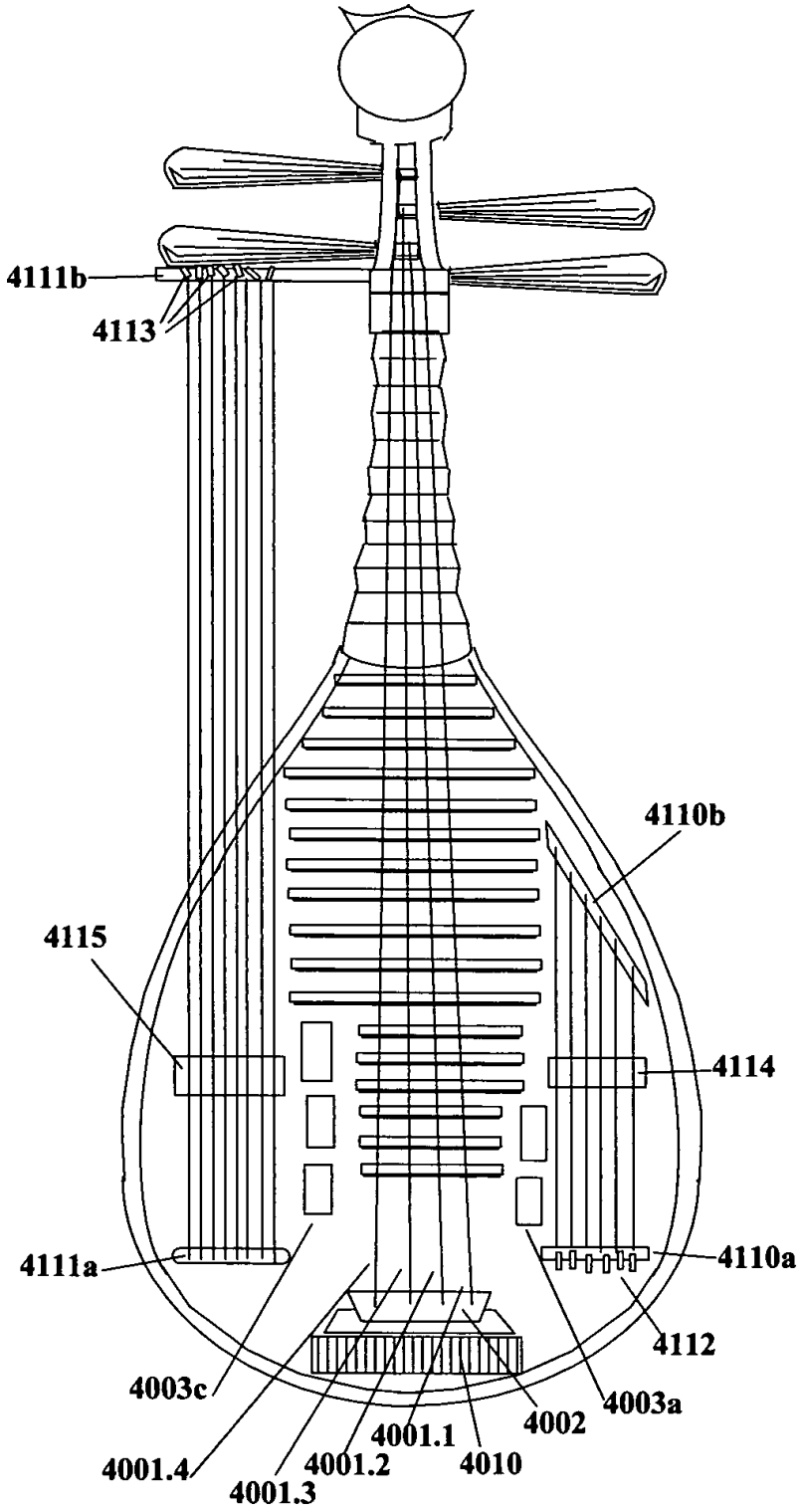

4111b
4113
4110b
4115
4114
4111a
4110a
4112
4003c
4003a
4002
4001.1
4001.4
4001.2
4010
4001.3

Figure 42

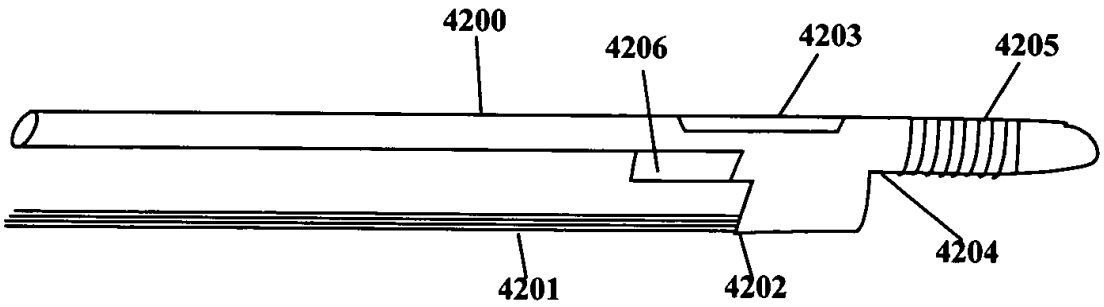


Figure 43

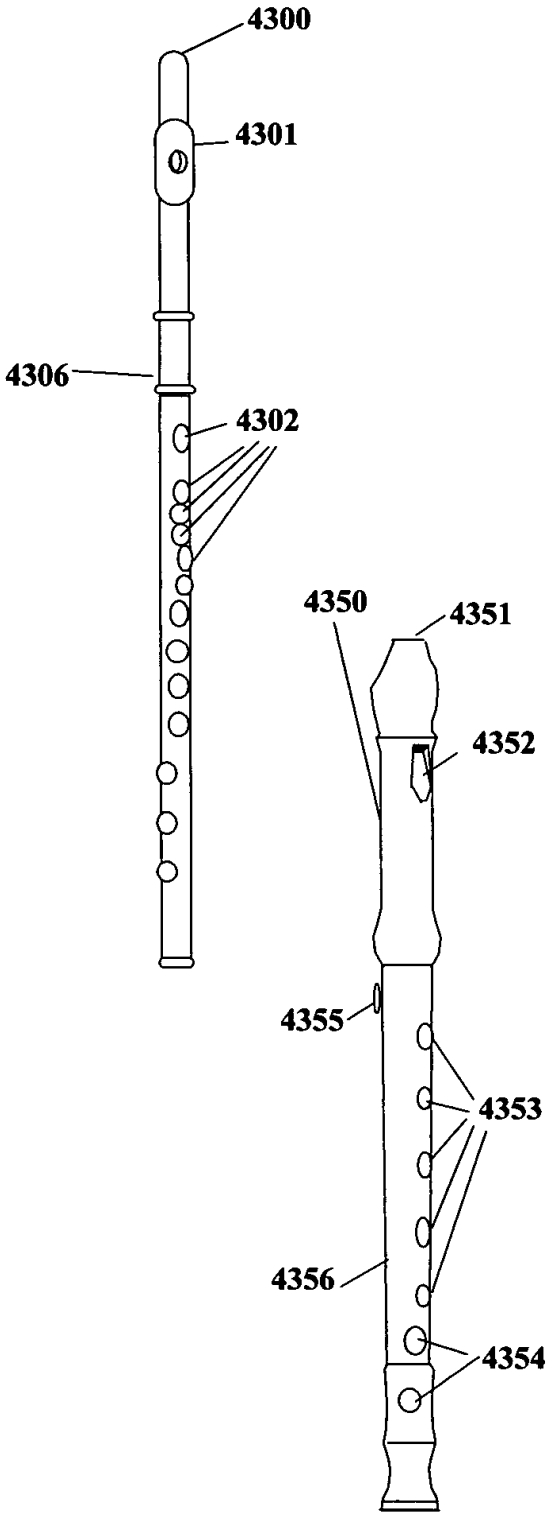


Figure 44

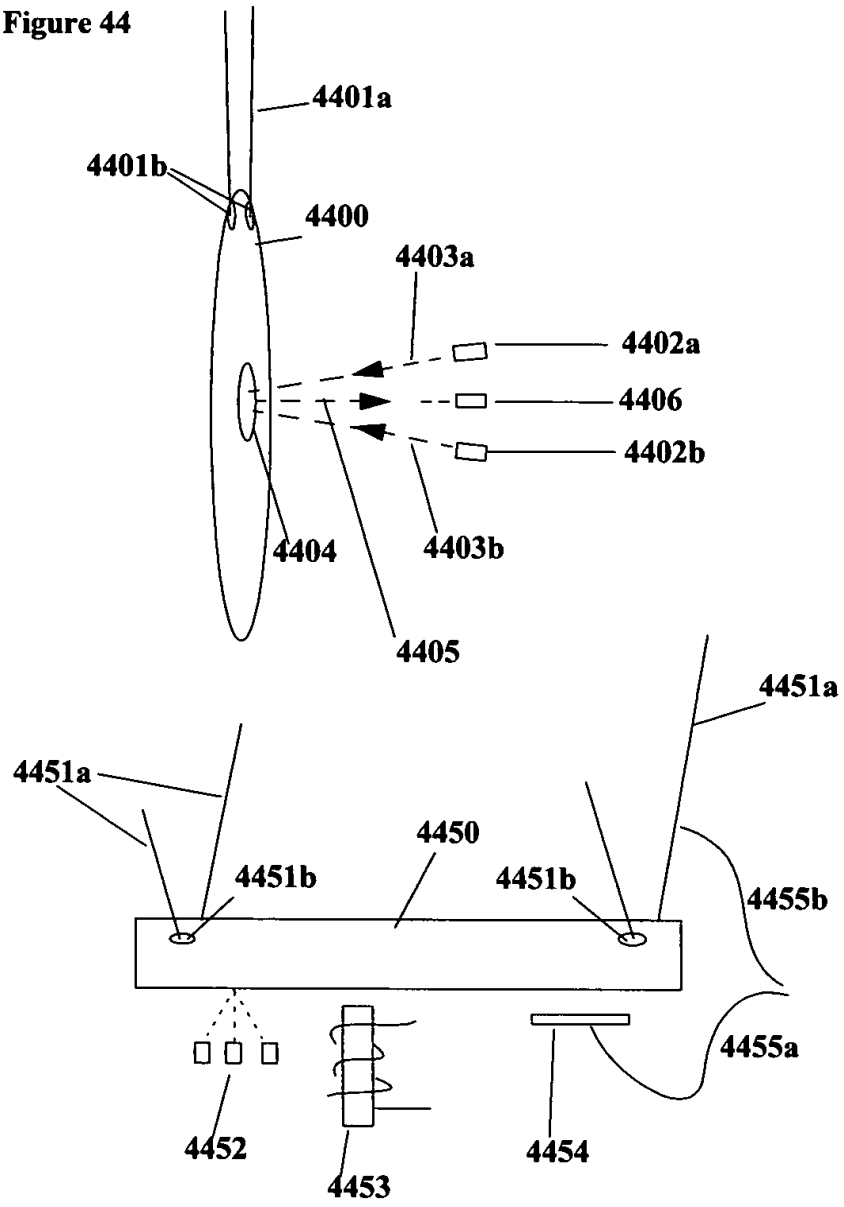

4401a
4401b
4400
4403a
4402a
4406
4402b
4404
4403b
4405
4451a
4451a
4450
4451b
4451b
4455b
4455a
4452
4453
4454

Figure 45

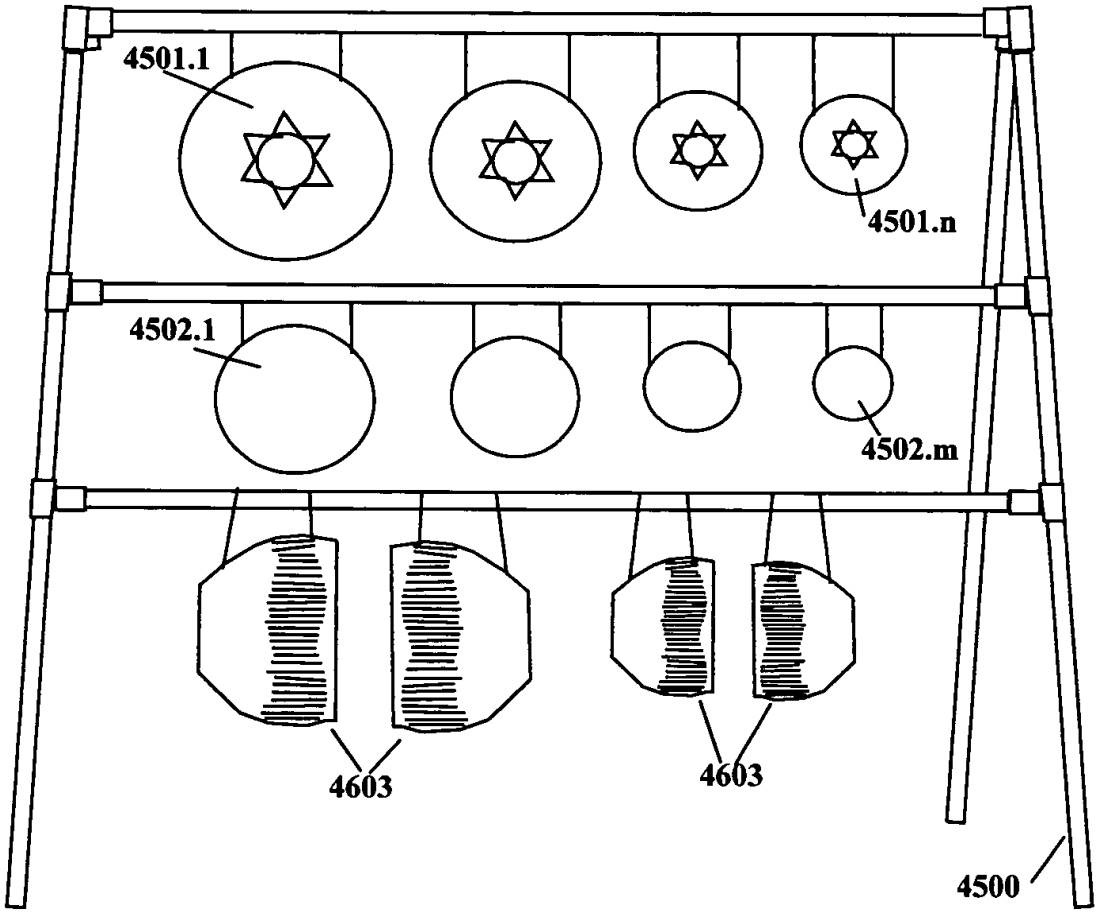
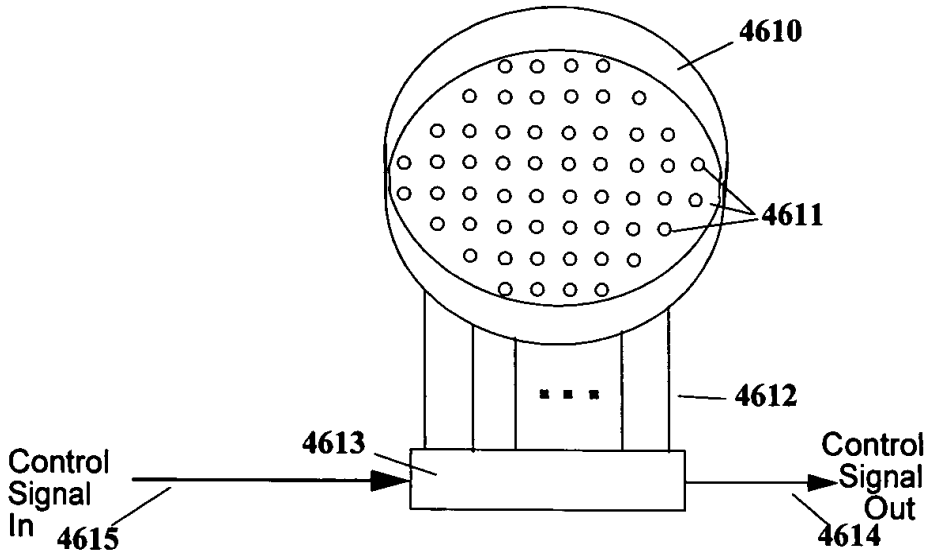


Figure 46


4610
4611
4612
4613
Control Signal In
4615
Control Signal Out
4614

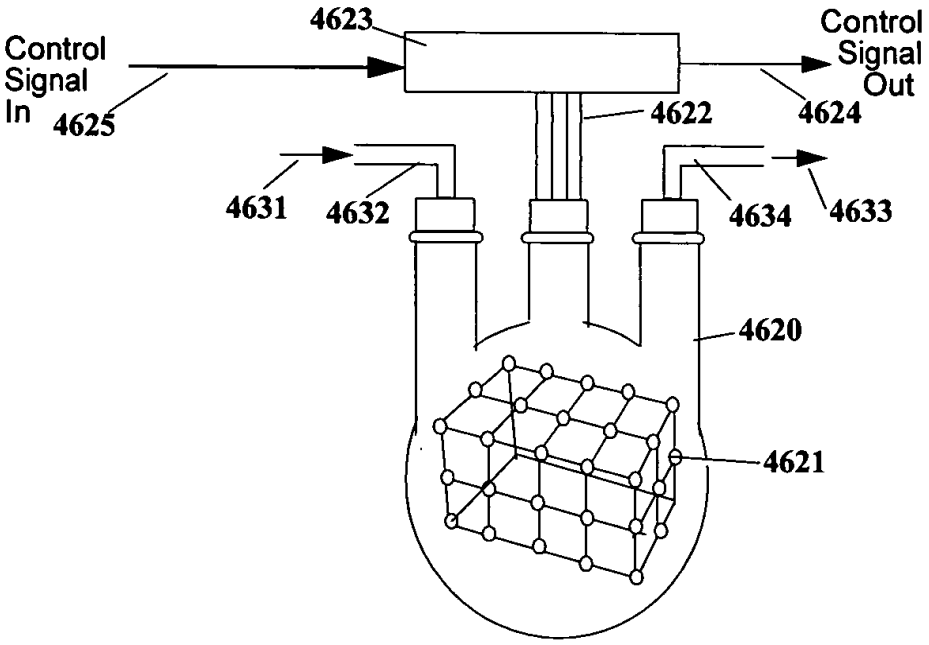

4623
Control Signal In
4625
Control Signal Out
4624
4622
4631
4632
4634
4633
4620
4621

Figure 47

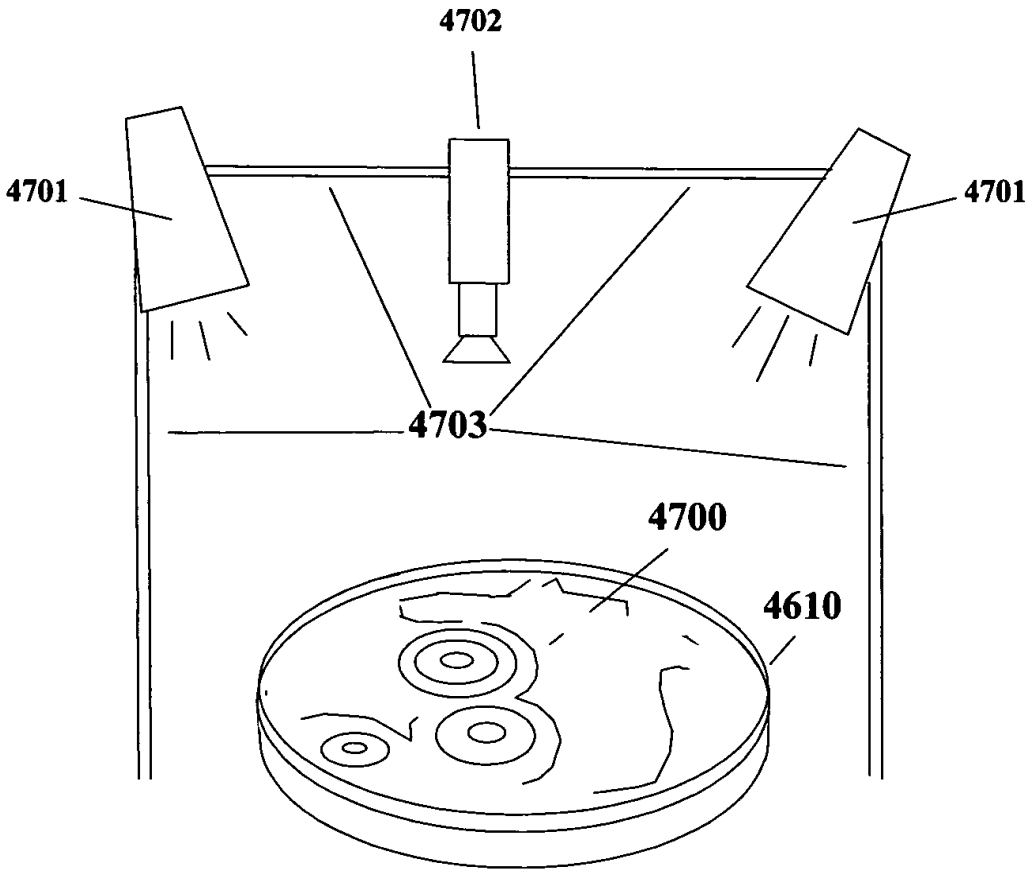


Figure 48

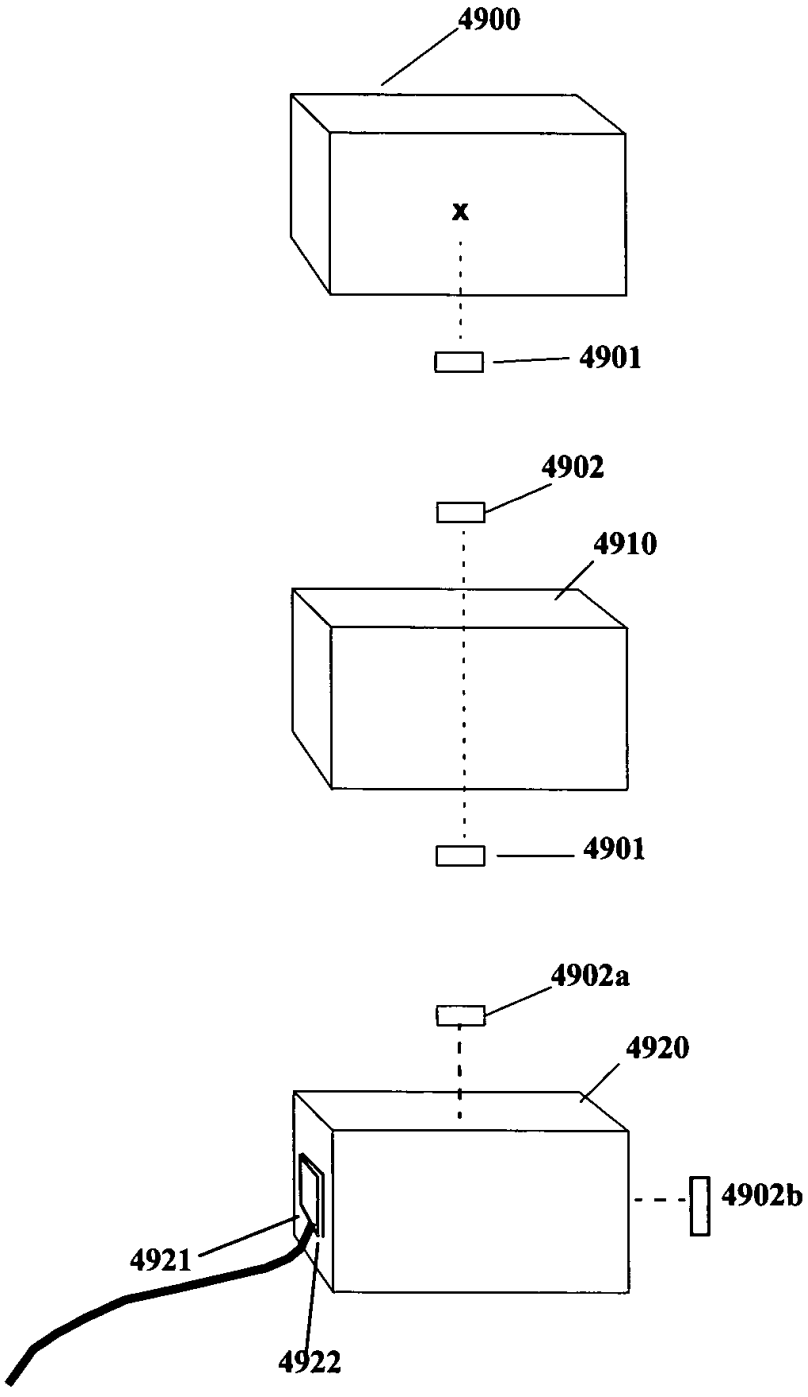
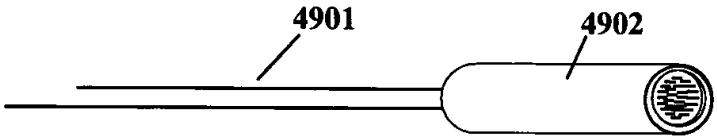


Figure 49


4901
4902

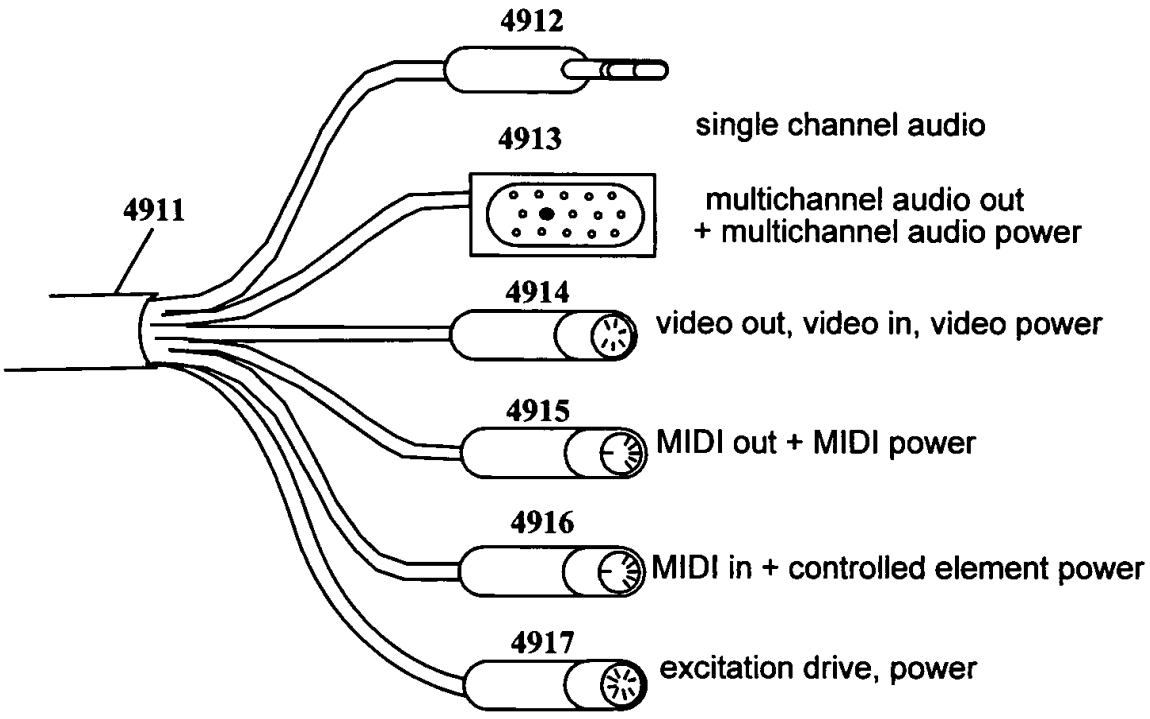

4912
single channel audio
4913
multichannel audio out
+ multichannel audio power
4911
4914
video out, video in, video power
4915
MIDI out + MIDI power
4916
MIDI in + controlled element power
4917
excitation drive, power

Figure 50

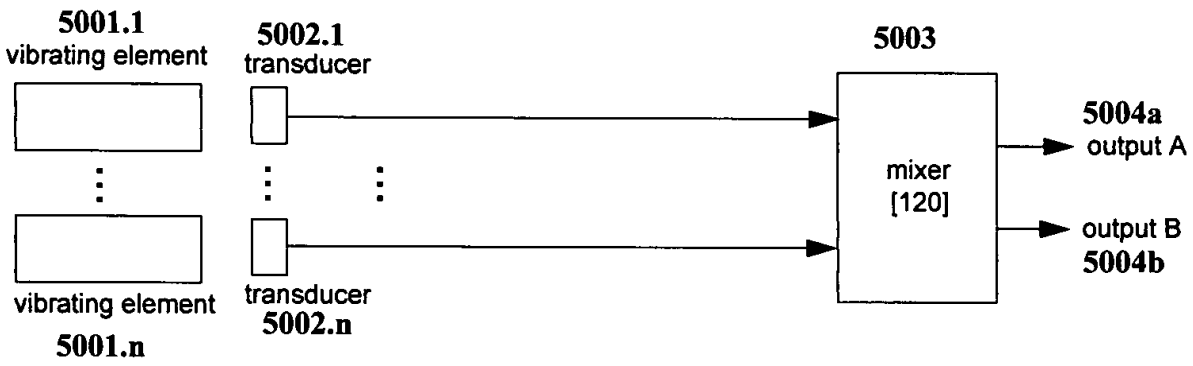

5001.1
vibrating element
5002.1
transducer
5003
mixer
[120]
5004a
output A
output B
5004b
vibrating element
5001.n
transducer
5002.n

Figure 51

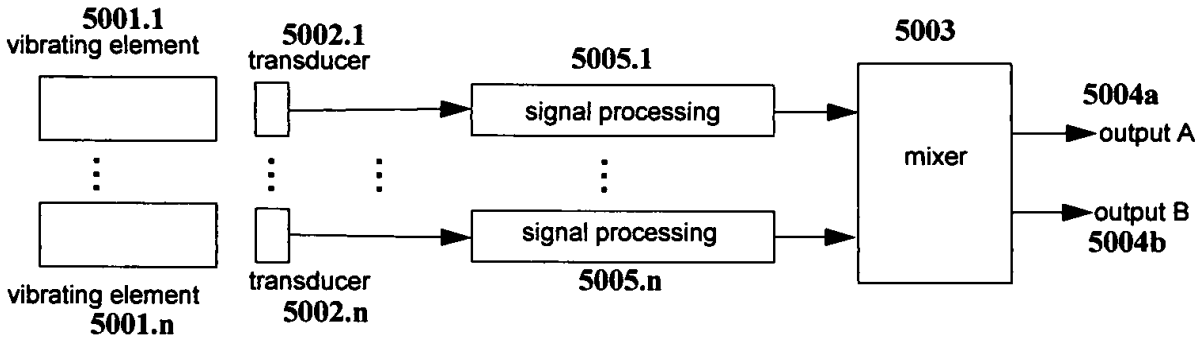

5001.1
vibrating element
5002.1
transducer
5005.1
signal processing
5003
mixer
5004a
output A
output B
5004b
signal processing
5005.n
transducer
5002.n
vibrating element
5001.n

Figure 52

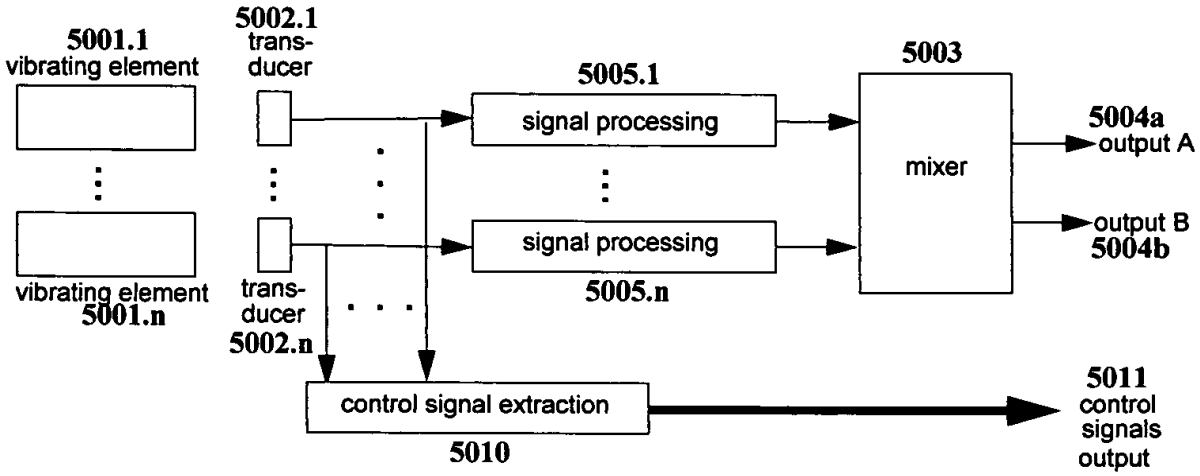

5001.1
vibrating element
vibrating element
5001.n
5002.1
trans-
ducer
trans-
ducer
5002.n
5005.1
signal processing
signal processing
5005.n
5003
mixer
5004a
output A
output B
5004b
control signal extraction
5010
5011
control
signals
output

Figure 53

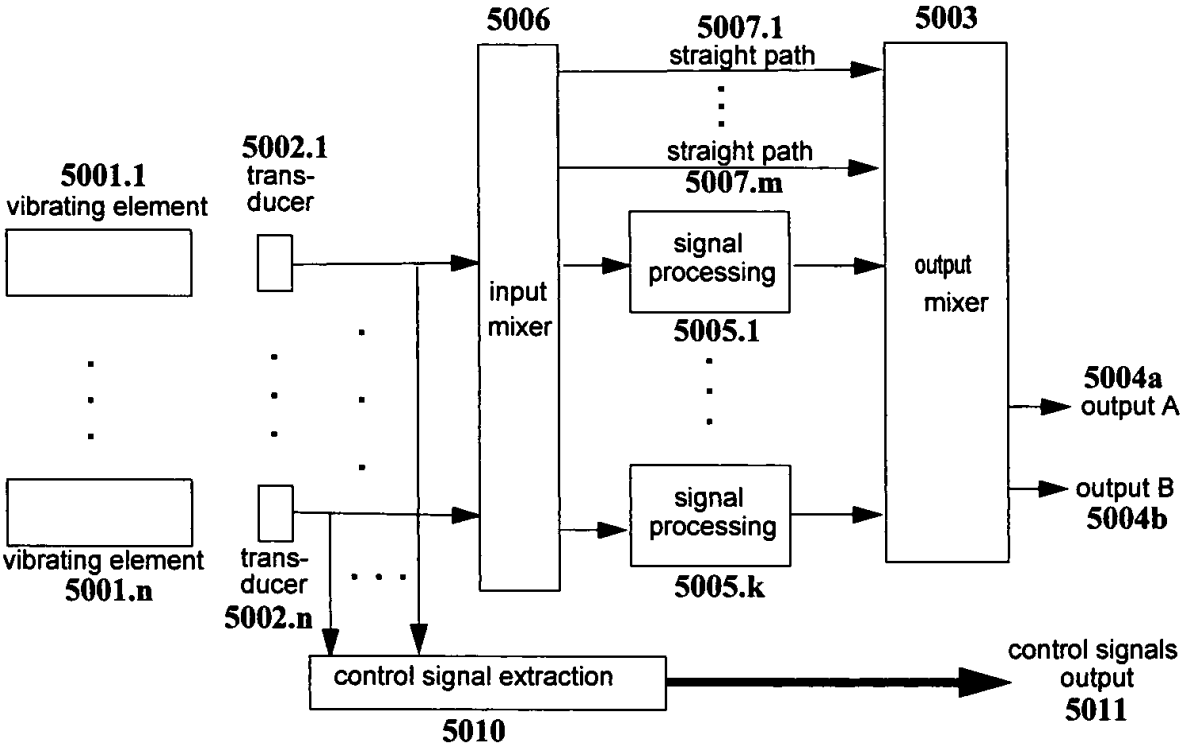

5006
5007.1
straight path
5003
5001.1
vibrating element
5002.1
trans-
ducer
straight path
5007.m
signal
processing
input
mixer
output
mixer
5005.1
5004a
output A
output B
5004b
vibrating element
5001.n
trans-
ducer
5002.n
signal
processing
5005.k
control signal extraction
5010
control signals
output
5011

Figure 54

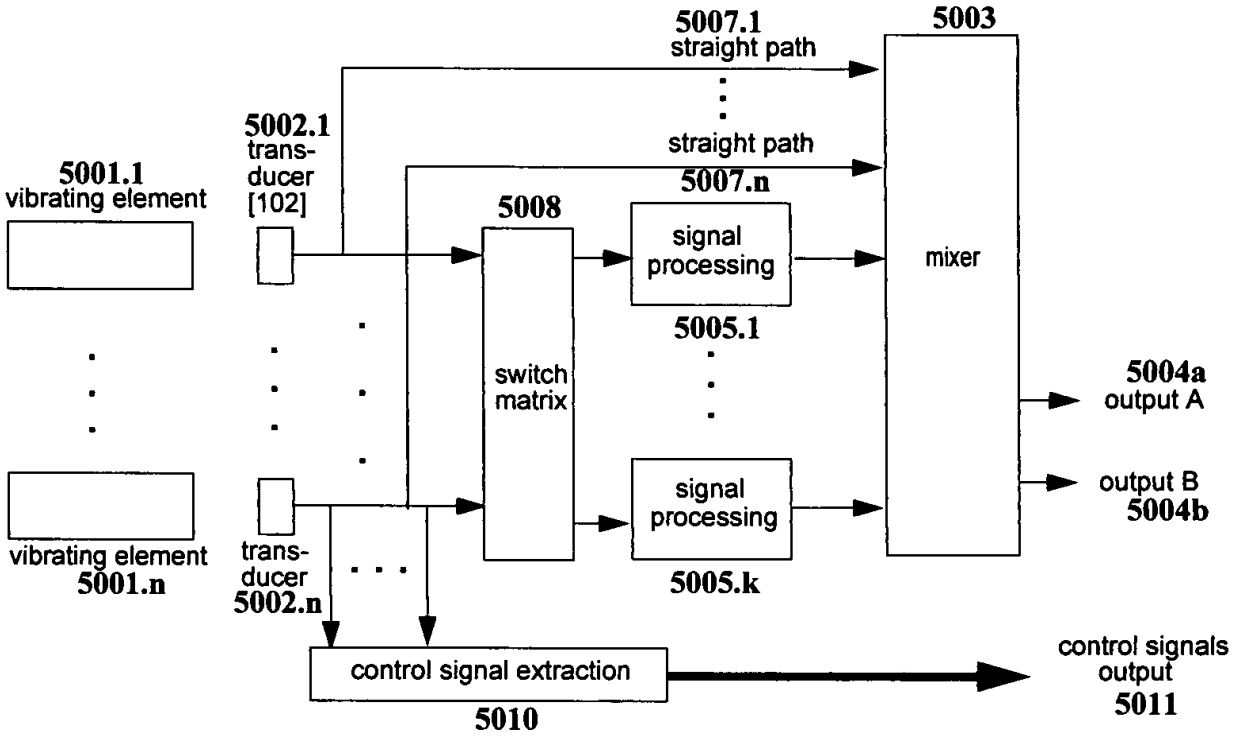

5007.1
straight path
5003
5002.1
trans-
ducer
[102]
straight path
5007.n
5001.1
vibrating element
5008
signal
processing
mixer
5005.1
switch
matrix
5004a
output A
output B
5004b
signal
processing
vibrating element
5001.n
trans-
ducer
5002.n
5005.k
control signal extraction
5010
control signals
output
5011

Figure 55

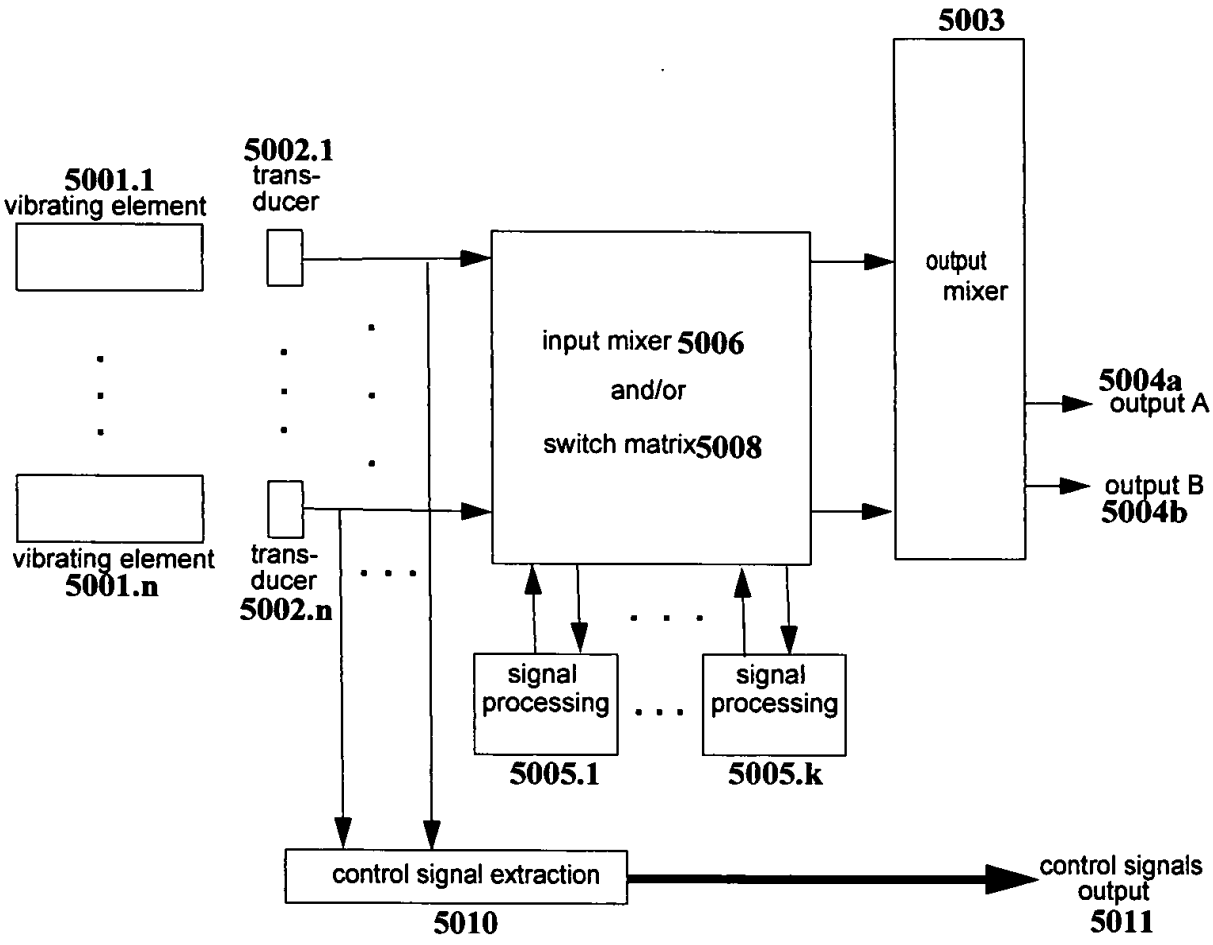

5003
5001.1
vibrating element
5002.1
trans-
ducer
output
mixer
input mixer 5006
and/or
switch matrix5008
5004a
output A
output B
5004b
vibrating element
5001.n
trans-
ducer
5002.n
signal
processing
signal
processing
5005.1
5005.k
control signal extraction
5010
control signals
output
5011

Figure 56

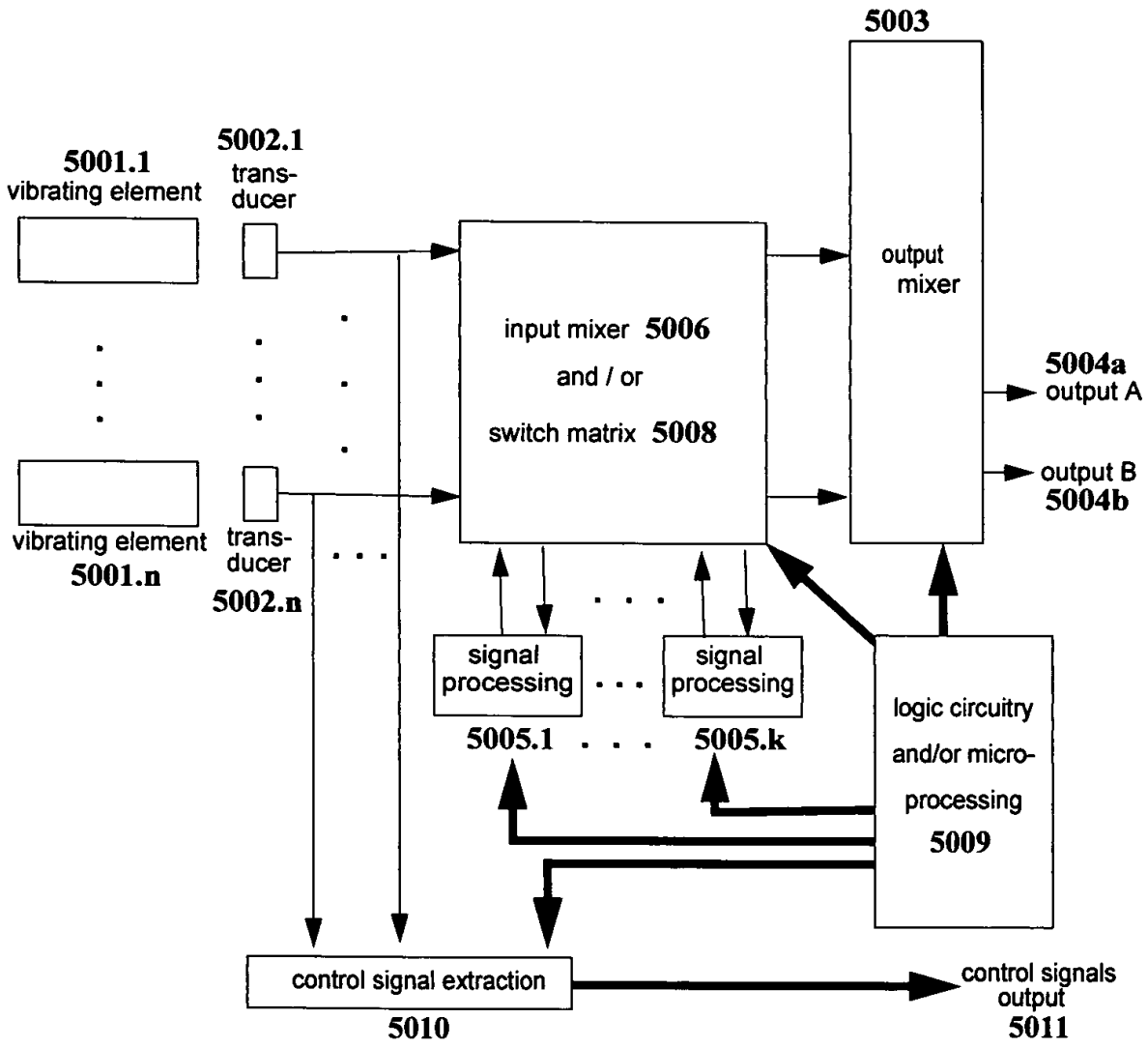

5003
5001.1
vibrating element
5002.1
trans-
ducer
output
mixer
input mixer 5006
and / or
switch matrix 5008
5004a
output A
output B
5004b
vibrating element
5001.n
trans-
ducer
5002.n
signal
processing
signal
processing
5005.1
5005.k
logic circuitry
and/or micro-
processing
5009
control signal extraction
5010
control signals
output
5011

Figure 57

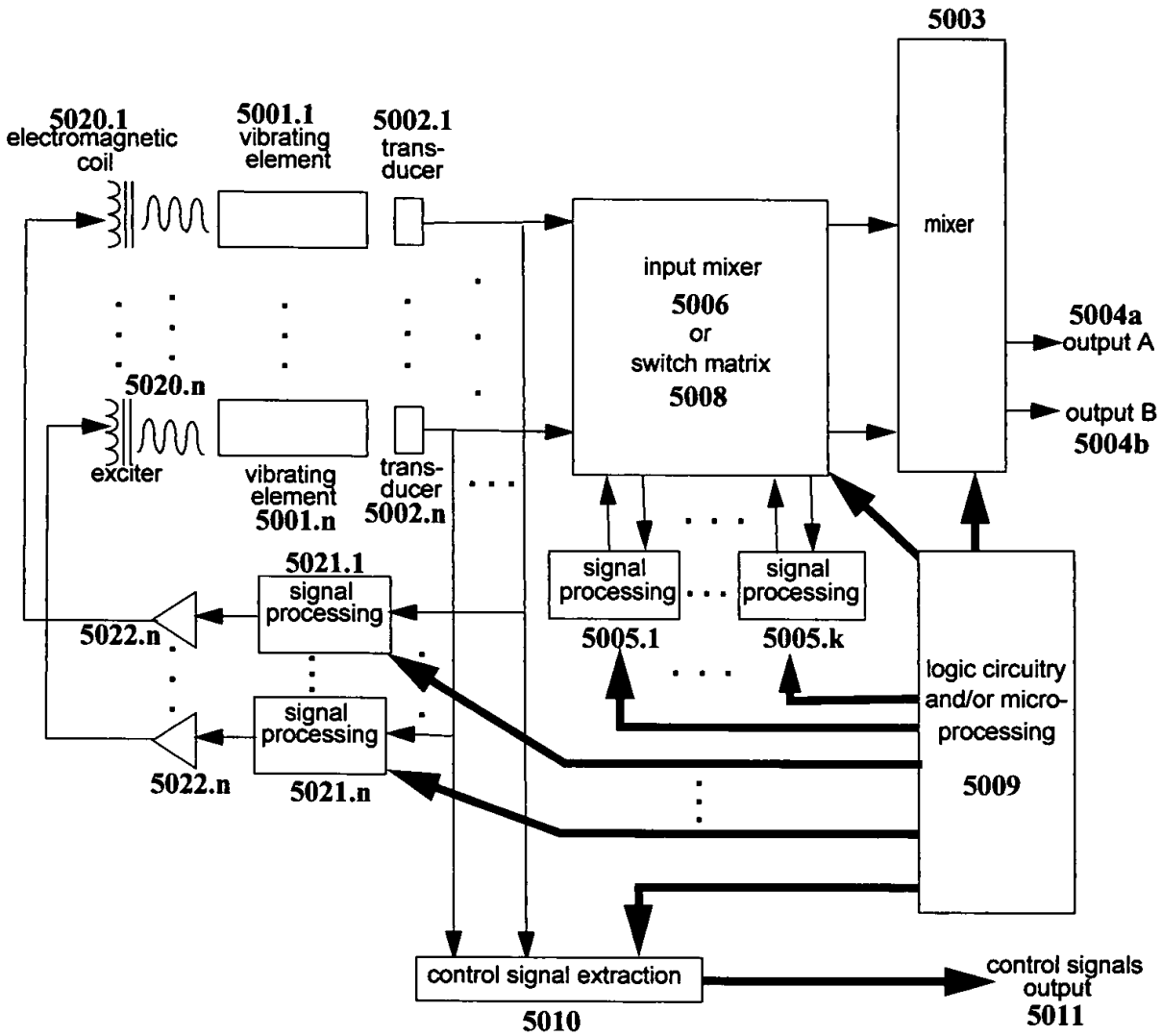

5003
5020.1
electromagnetic coil
5001.1
vibrating element
5002.1
trans-ducer
mixer
input mixer
5006
or
switch matrix
5008
5004a
output A
output B
5004b
5020.n
exciter
vibrating element
5001.n
trans-ducer
5002.n
5021.1
signal processing
5022.n
signal processing
5005.1
signal processing
5005.k
logic circuitry and/or micro-processing
5009
signal processing
5022.n
5021.n
control signal extraction
5010
control signals output
5011

Figure 58

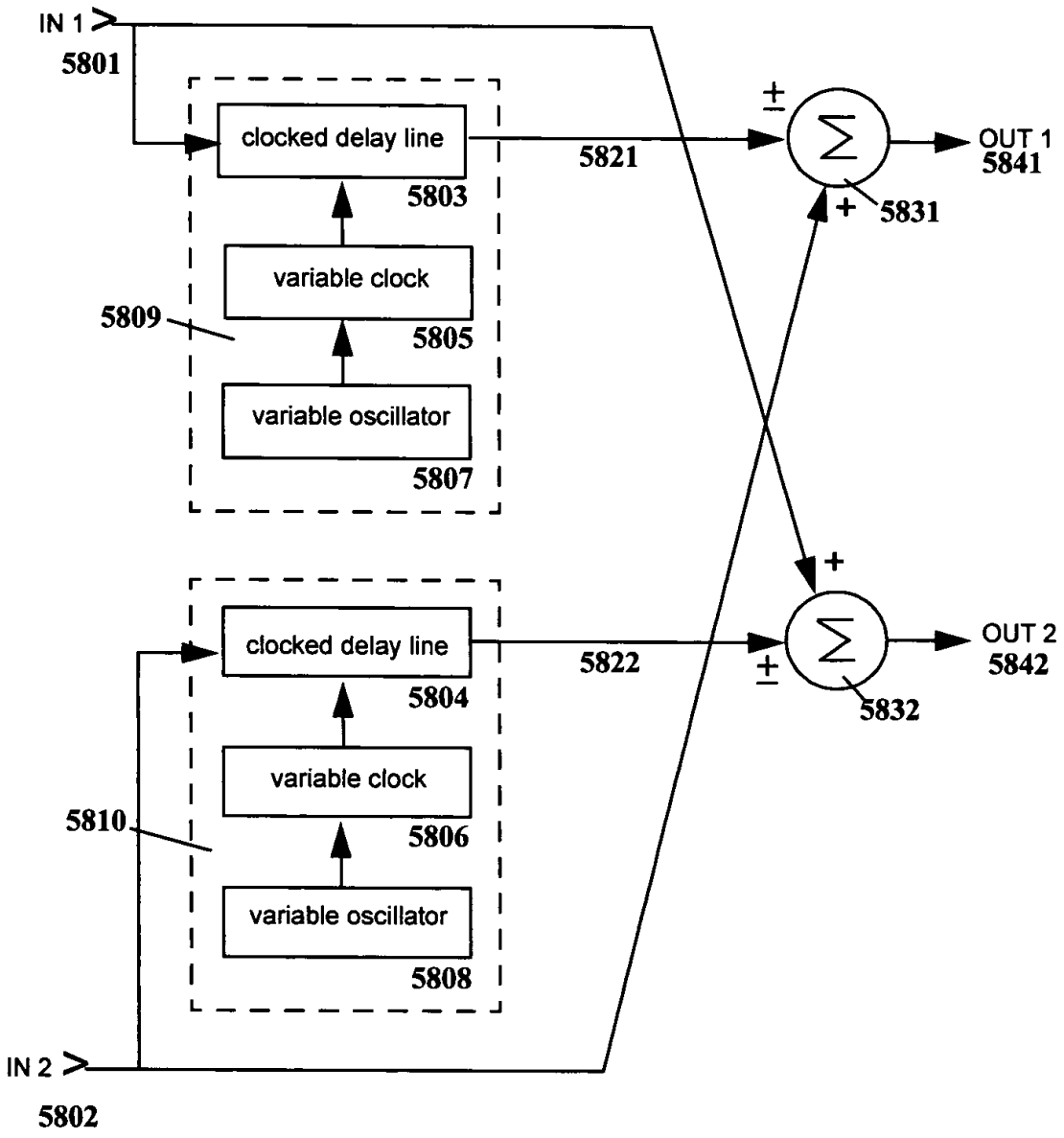

IN 1
5801
clocked delay line
5803
variable clock
5805
5809
variable oscillator
5807
5821
±
Σ
+
5831
OUT 1
5841
+
clocked delay line
5804
variable clock
5806
5810
variable oscillator
5808
5822
±
Σ
5832
OUT 2
5842
IN 2
5802

Figure 59

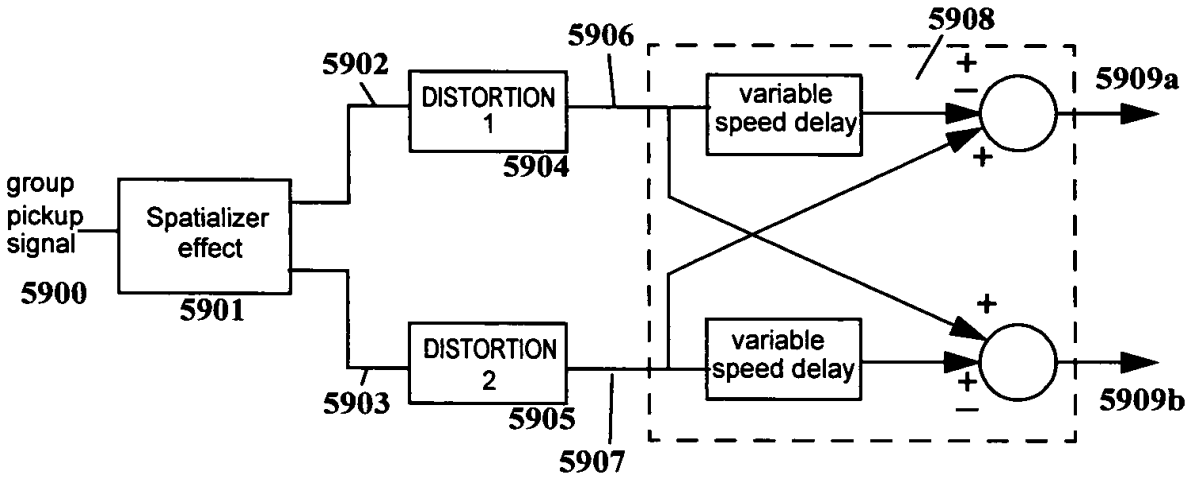

group
pickup
signal
5900
Spatializer
effect
5901
5902
DISTORTION
1
5904
5903
DISTORTION
2
5905
5906
5907
5908
variable
speed delay
variable
speed delay
+
−
+
+
+
−
5909a
5909b

Figure 60

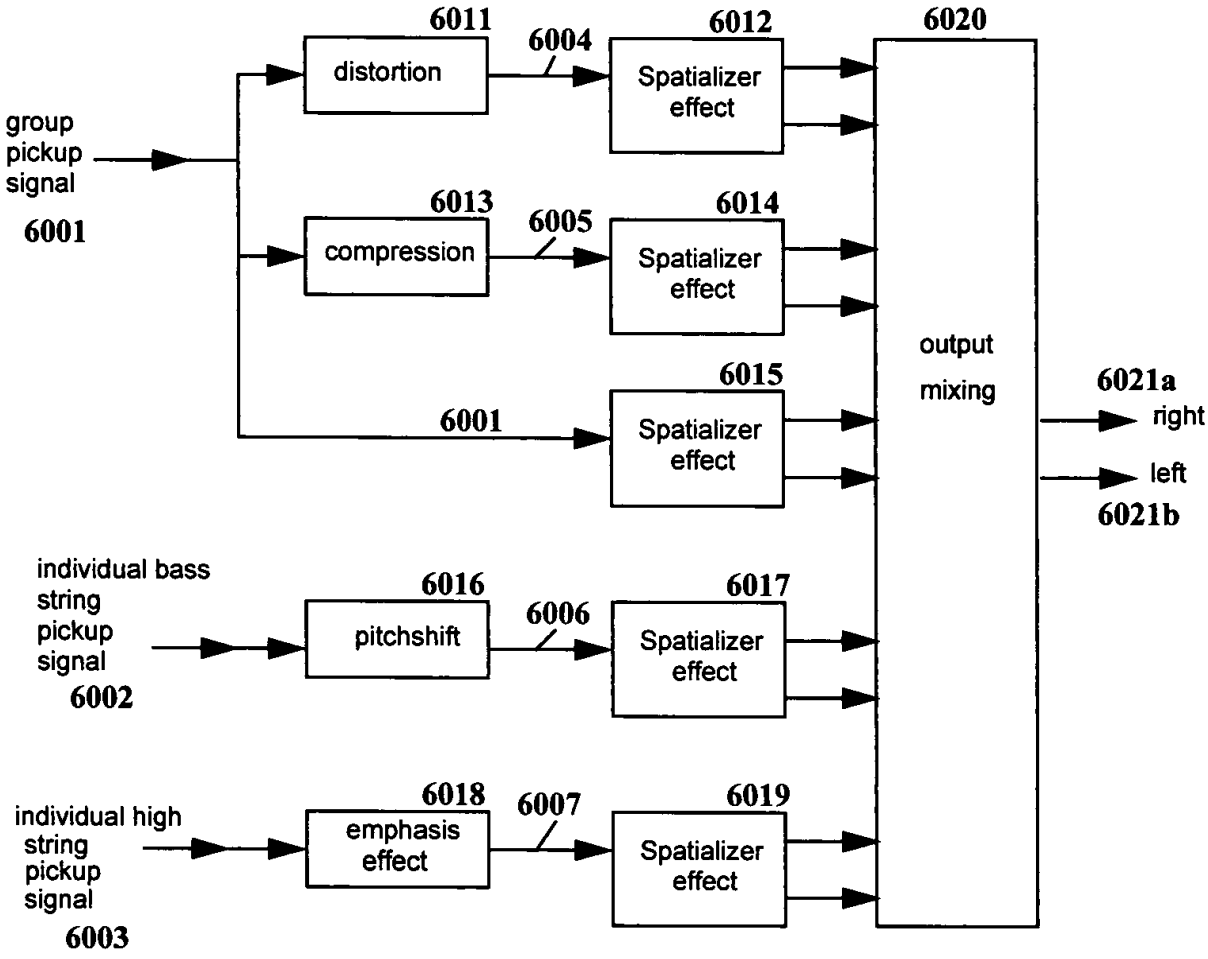
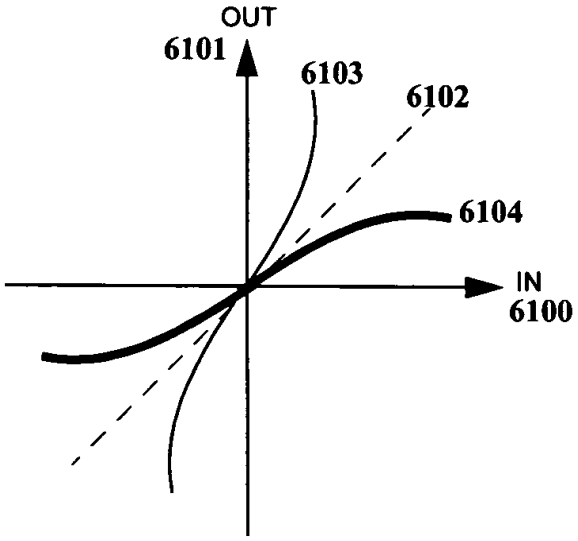
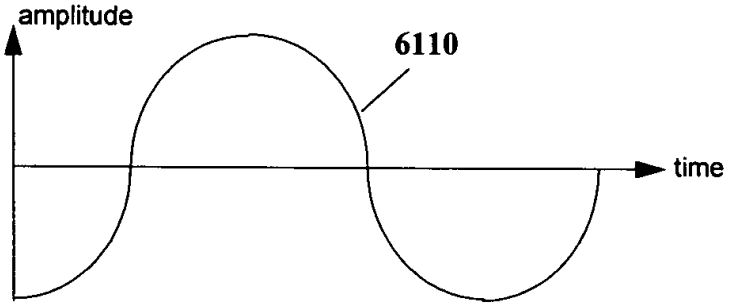

group pickup signal
6001
distortion
6011
6004
Spatializer effect
6012
6020
compression
6013
6005
Spatializer effect
6014
output mixing
6001
Spatializer effect
6015
6021a
right
left
6021b
individual bass string pickup signal
6002
pitchshift
6016
6006
Spatializer effect
6017
individual high string pickup signal
6003
emphasis effect
6018
6007
Spatializer effect
6019

Figure 61


OUT
6101
6103
6102
6104
IN
6100


amplitude
6110
time

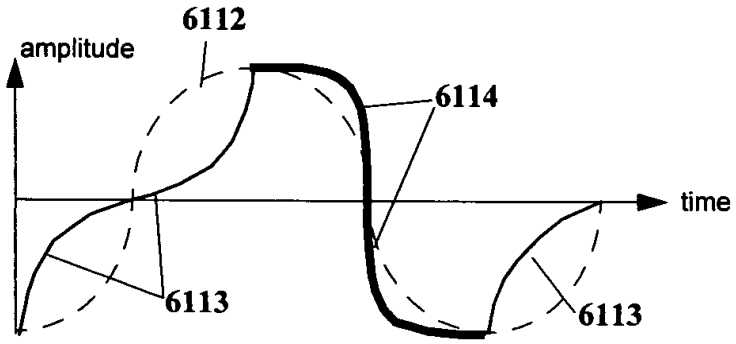

6112
amplitude
6114
time
6113
6113

Figure 62

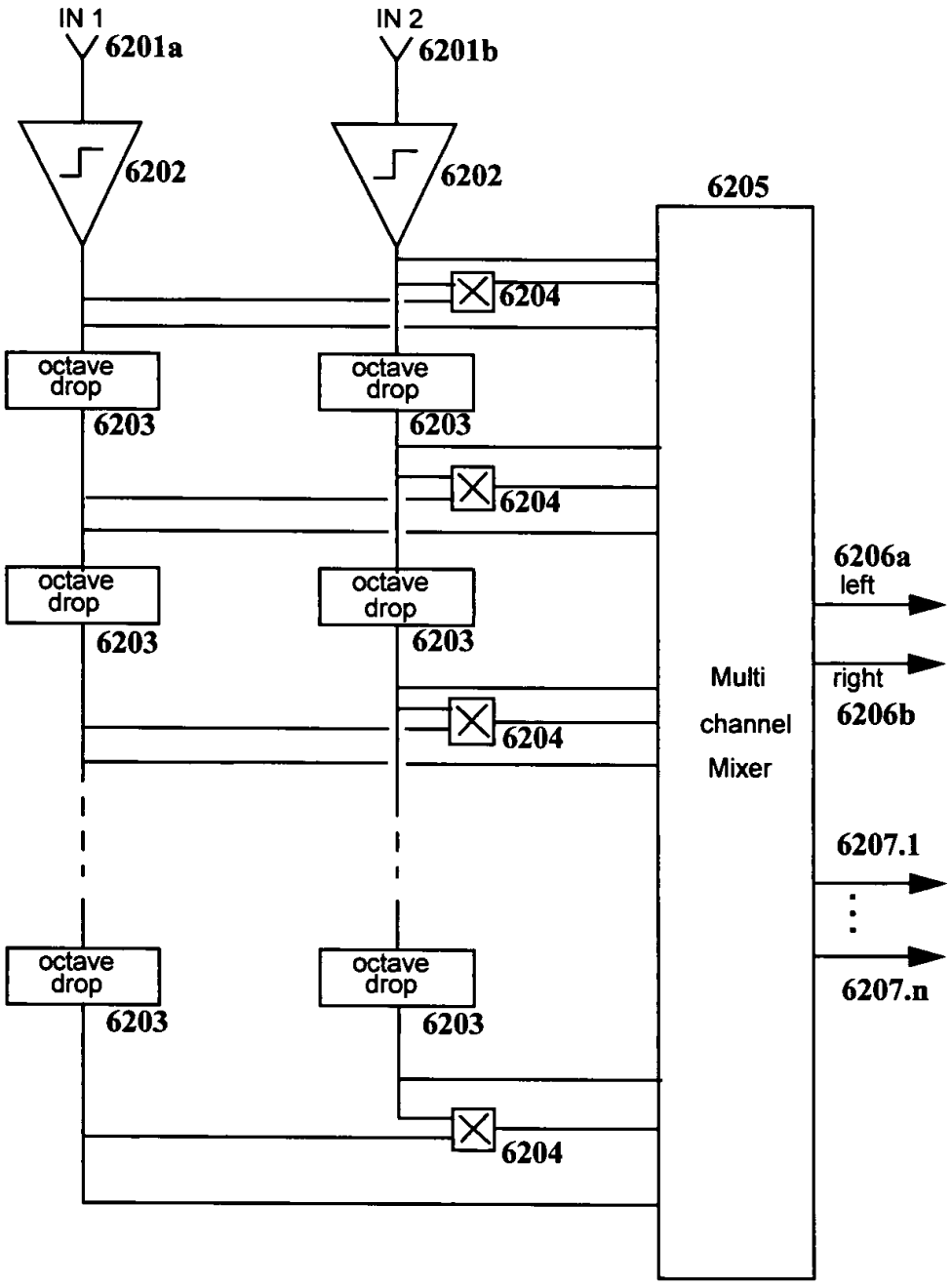

IN 1
6201a
IN 2
6201b
6202
6202
6205
6204
octave drop
6203
octave drop
6203
6204
octave drop
6203
octave drop
6203
6206a
left
right
6206b
Multi channel Mixer
6204
6207.1
6207.n
octave drop
6203
octave drop
6203
6204

Figure 63

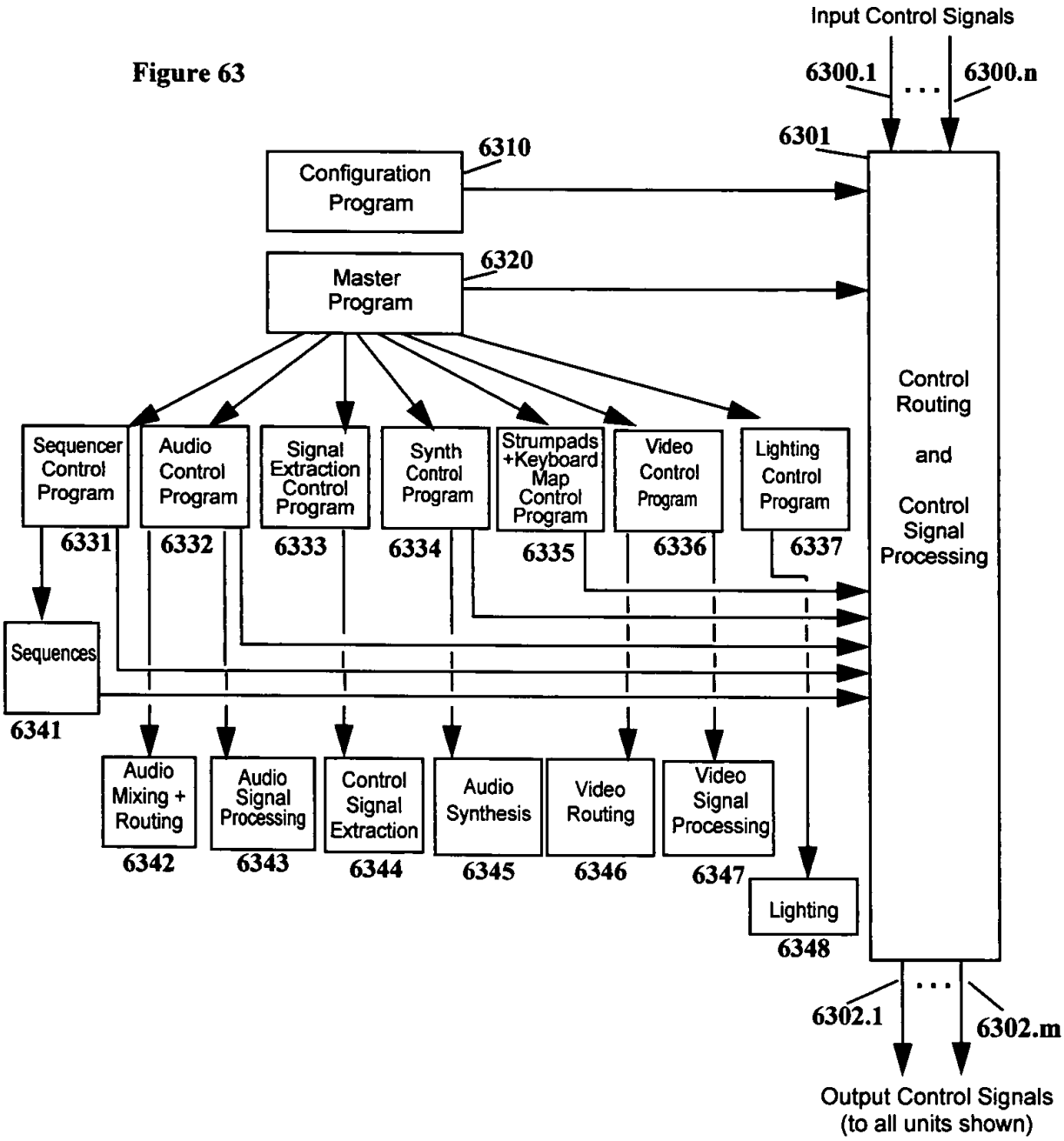

Input Control Signals
6300.1
6300.n
6301
6310
Configuration Program
6320
Master Program
Control Routing and Control Signal Processing
Sequencer Control Program
Audio Control Program
Signal Extraction Control Program
Synth Control Program
Strumpads +Keyboard Map Control Program
Video Control Program
Lighting Control Program
6331
6332
6333
6334
6335
6336
6337
Sequences
6341
Audio Mixing + Routing
Audio Signal Processing
Control Signal Extraction
Audio Synthesis
Video Routing
Video Signal Processing
6342
6343
6344
6345
6346
6347
Lighting
6348
6302.1
6302.m
Output Control Signals
(to all units shown)

Figure 64

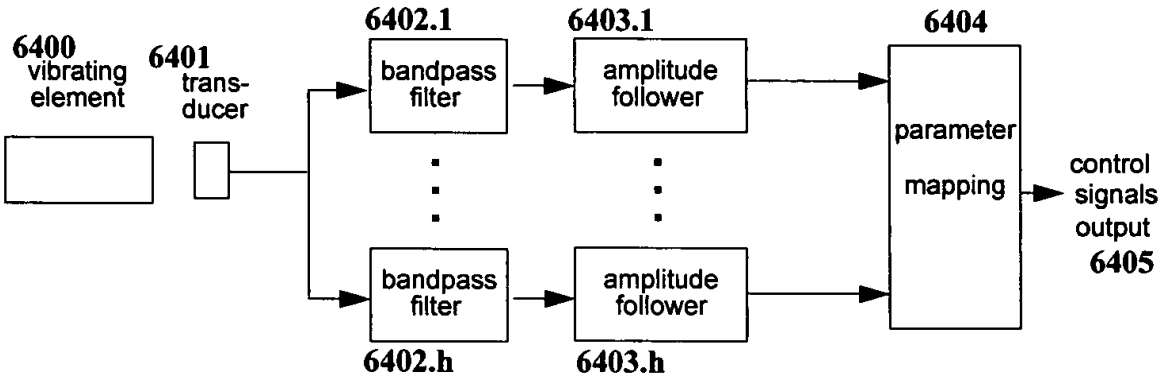

6400
vibrating element
6401
trans-ducer
6402.1
bandpass filter
6403.1
amplitude follower
6404
parameter mapping
control signals output
6405
bandpass filter
amplitude follower
6402.h
6403.h

Figure 65

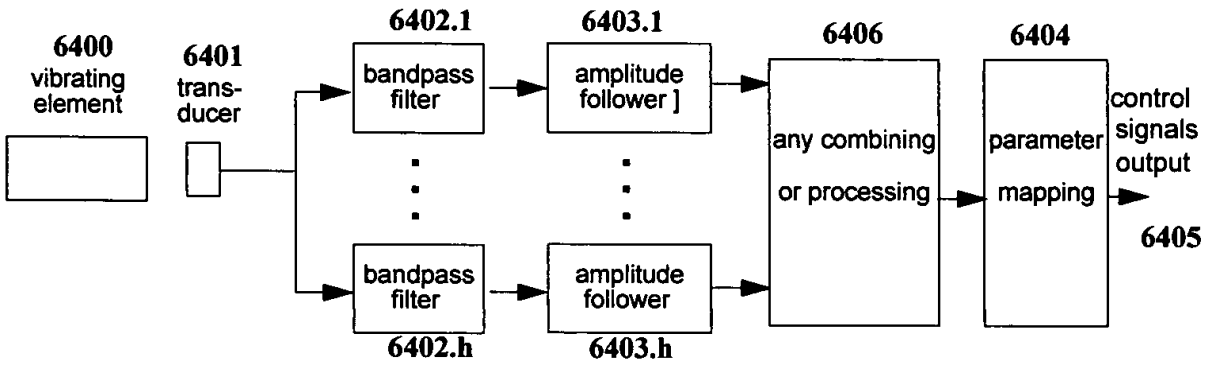

6400
vibrating element
6401
trans-ducer
6402.1
bandpass filter
6403.1
amplitude follower]
6406
any combining or processing
6404
parameter mapping
control signals output
6405
bandpass filter
6402.h
amplitude follower
6403.h

Figure 66

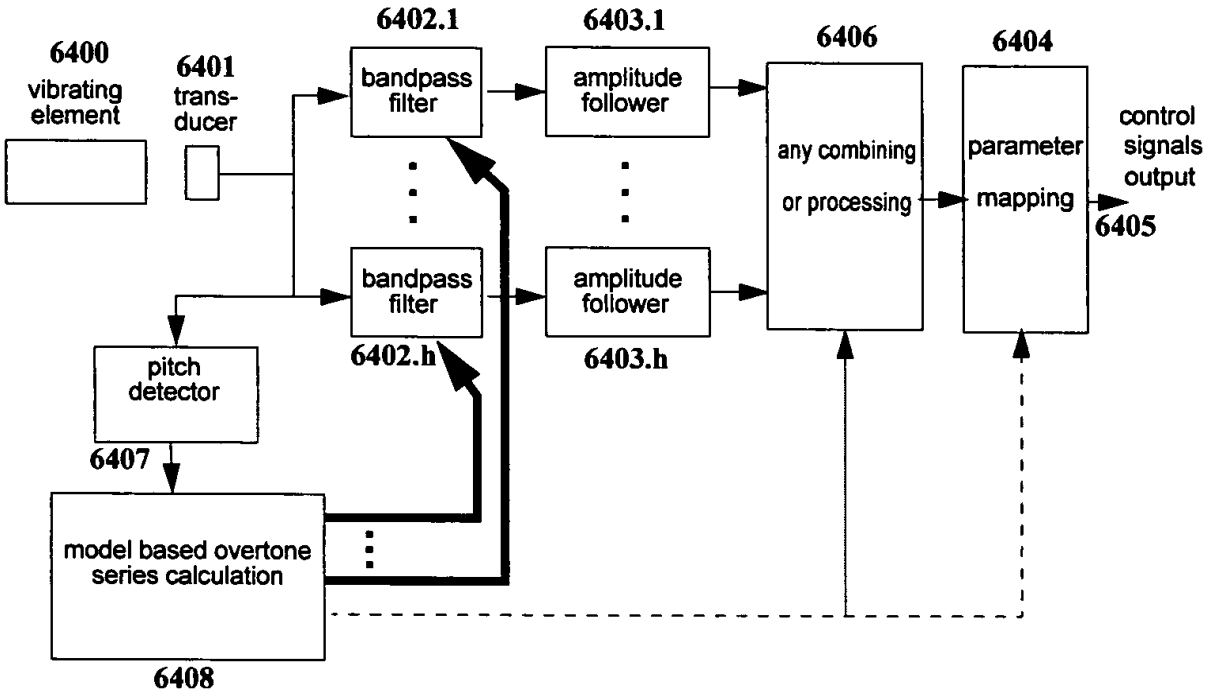

6400
vibrating element
6401
trans-ducer
6402.1
bandpass filter
6403.1
amplitude follower
6406
any combining or processing
6404
parameter mapping
control signals output
6405
bandpass filter
6402.h
amplitude follower
6403.h
pitch detector
6407
model based overtone series calculation
6408

Figure 67

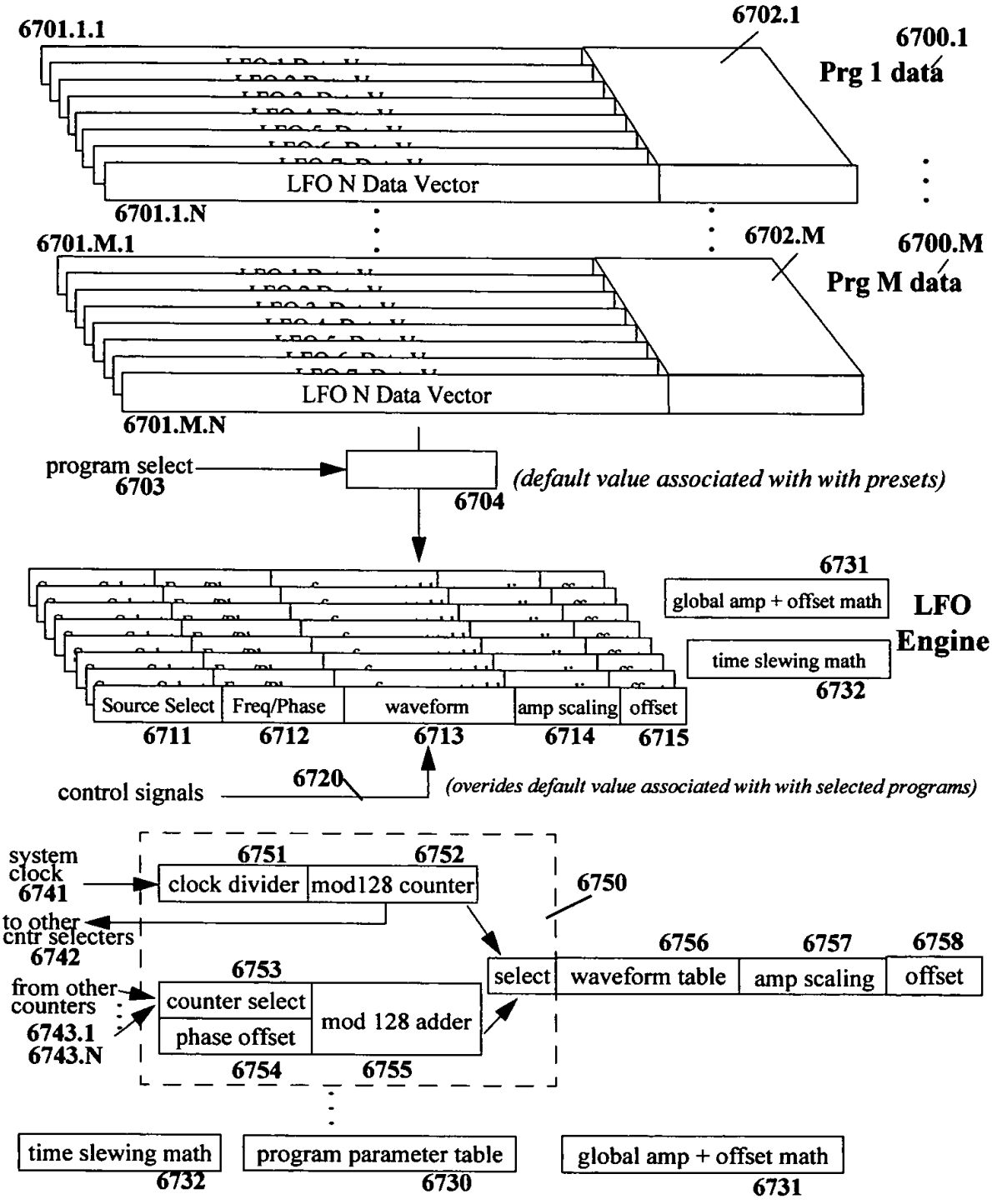

6701.1.1
6702.1
6700.1
Prg 1 data
LFO N Data Vector
6701.1.N
6701.M.1
6702.M
6700.M
Prg M data
LFO N Data Vector
6701.M.N
program select
6703
6704
(default value associated with with presets)
6731
global amp + offset math
LFO
Engine
time slewing math
6732
Source Select
Freq/Phase
waveform
amp scaling
offset
6711
6712
6713
6714
6715
control signals
6720
(overides default value associated with with selected programs)
system clock
6741
6751
6752
clock divider
mod128 counter
6750
to other cntr selecters
6742
6756
6757
6758
select
waveform table
amp scaling
offset
6753
from other counters
6743.1
6743.N
counter select
phase offset
mod 128 adder
6754
6755
time slewing math
6732
program parameter table
6730
global amp + offset math
6731

Figure 68

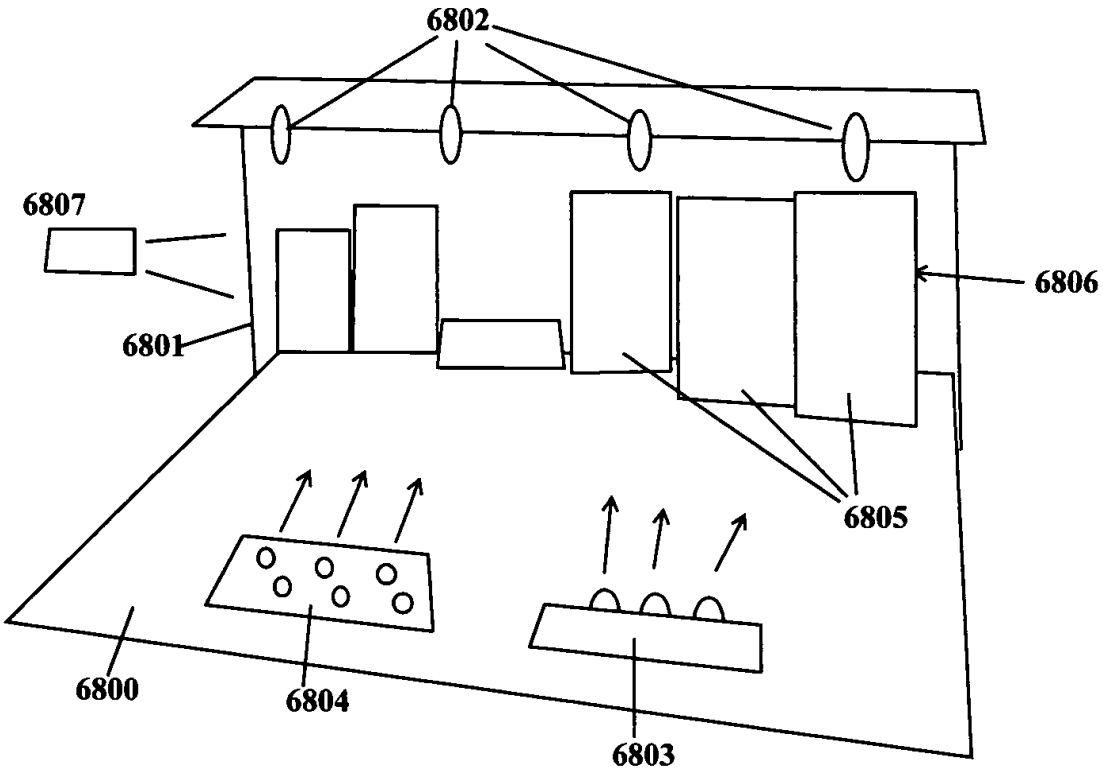


Figure 69

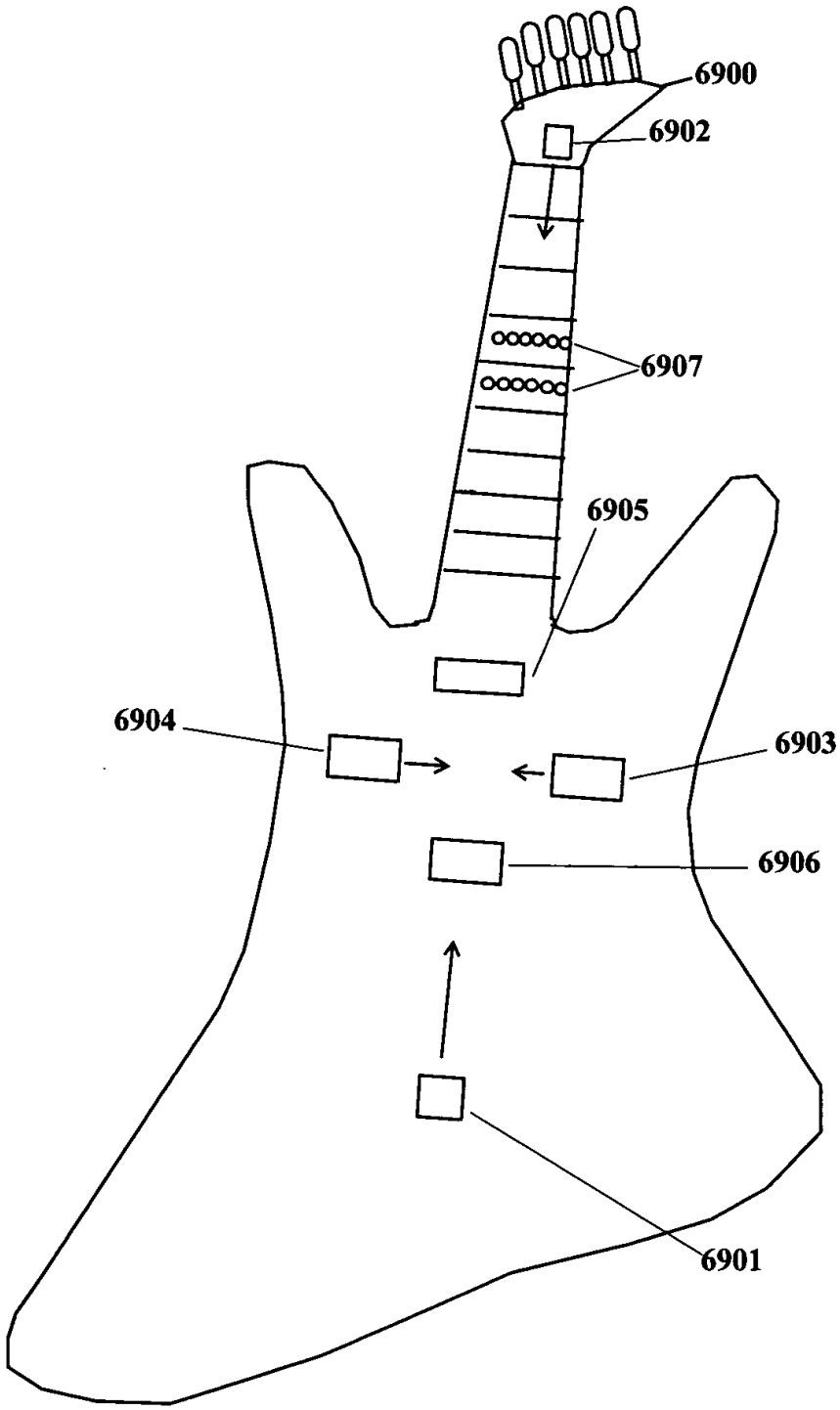


Figure 70

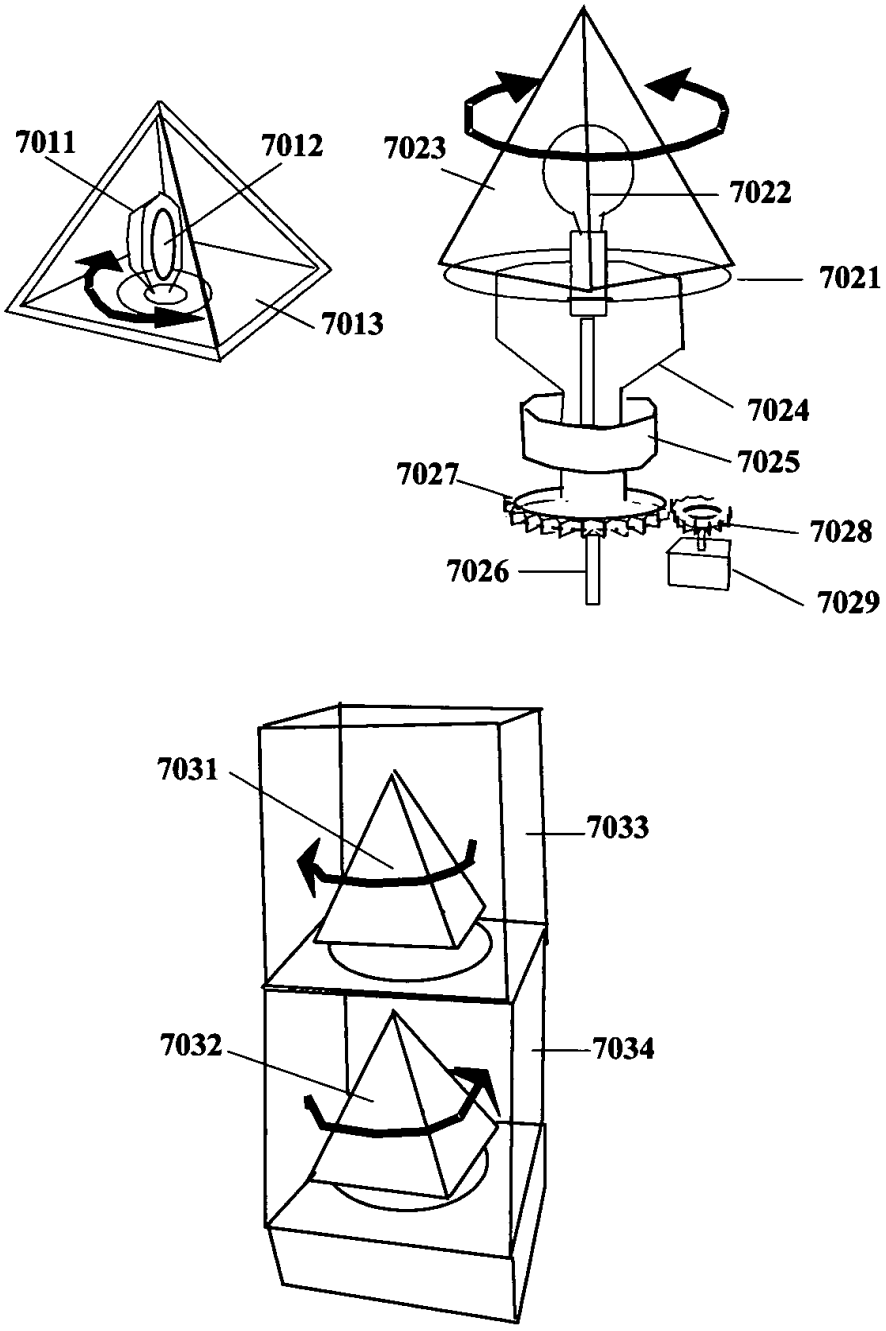
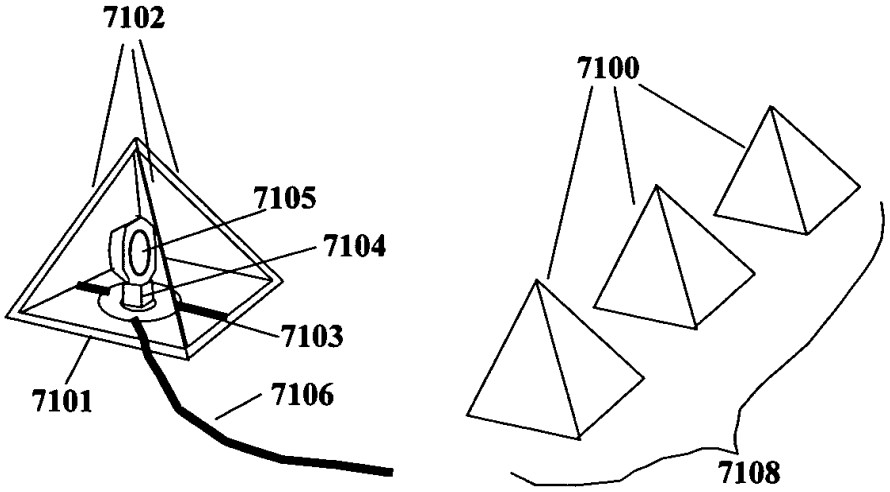
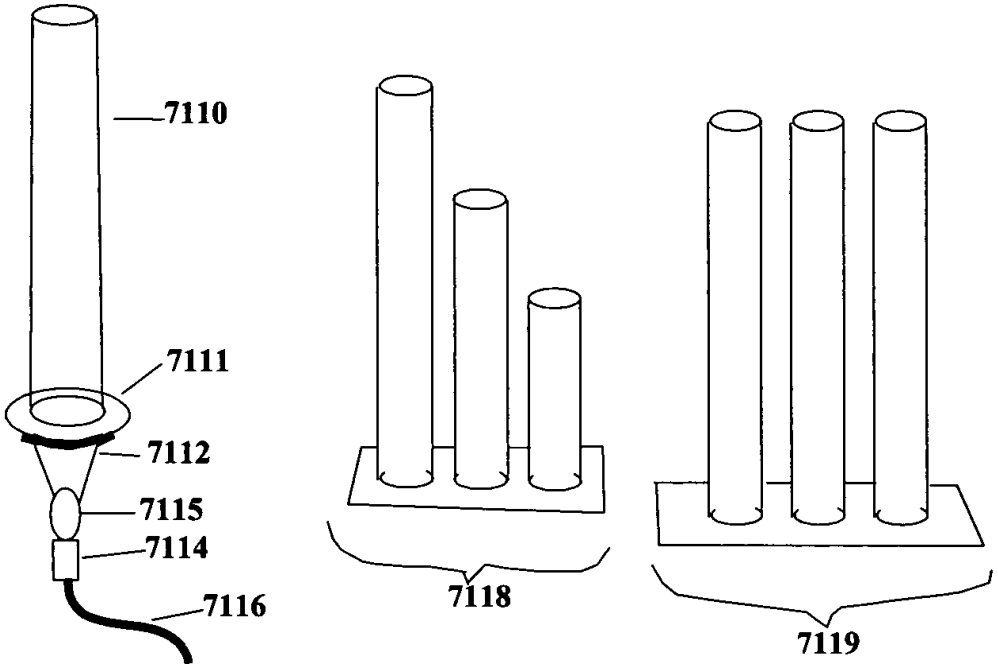

7011
7012
7013
7023
7022
7021
7024
7025
7027
7028
7026
7029
7031
7033
7032
7034

Figure 71


7102
7105
7104
7103
7101
7106
7100
7108


7110
7111
7112
7115
7114
7116
7118
7119

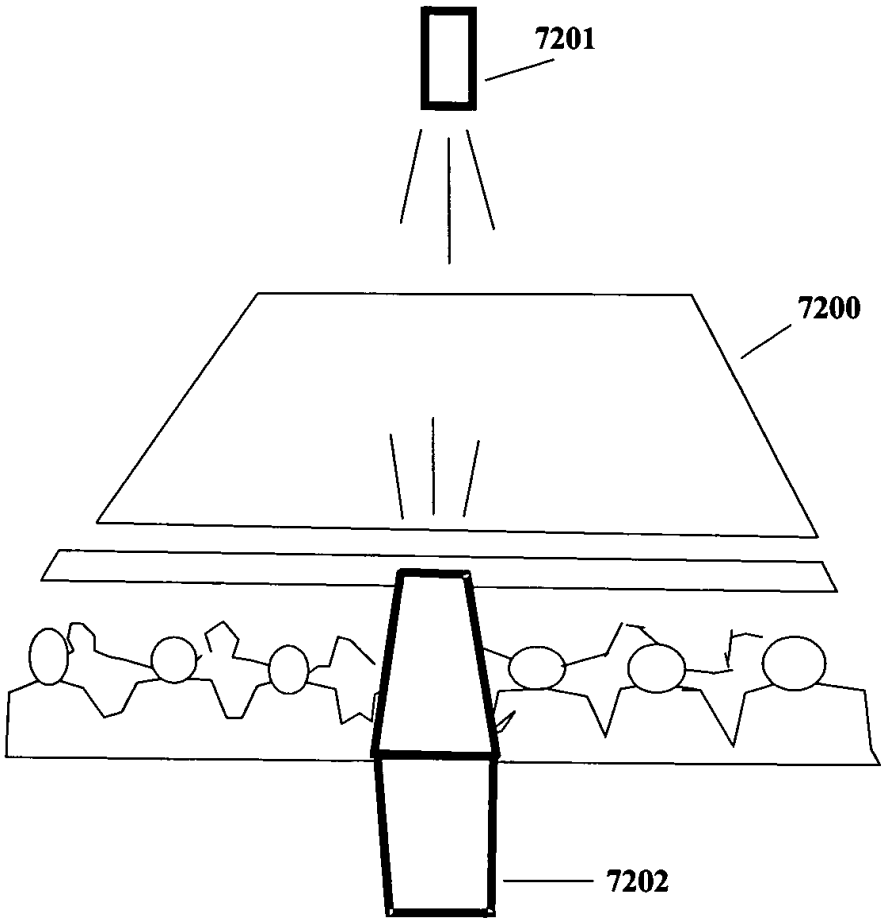



Figure 72